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BUREAU OF ECONOMIC GEOLOGY
The University of Texas at Austin
Austin, Texas 78712

William L. Fisher, Director

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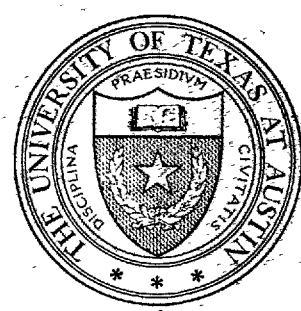
EDWARDS GROUP, SURFACE AND SUBSURFACE, CENTRAL TEXAS

By
Peter R. Rose



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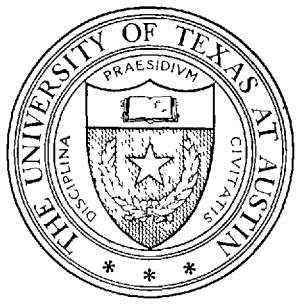

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CONTENTS

	PAGE
Abstract	1
Introduction	3
Regional geologic elements	3
Regional structure	3
Areas of investigation	7
Methods	7
Acknowledgments	10
Stratigraphy	12
History of previous investigations and nomenclature	12
Recommended stratigraphic nomenclature	18
Subsurface Edwards Group of south-central Texas	18
Fredericksburg-Washita stratigraphy of the Fashing-Person trend	18
Edwards Group	18
Edwards—Glen Rose boundary	18
Kainer Formation (new)	18
Dolomitic Member (informal)	19
Grainstone Member (informal)	19
Person Formation (new)	19
Person-Kainer boundary	19
Regional Dense Member (informal)	19
Collapsed Member (informal)	20
Leached Member (informal)	20
Marine Member (informal)	20
Cyclic Member (informal)	20
Edwards-Georgetown boundary	21
Georgetown Formation	23
Del Rio Clay	24
Buda Limestone	24
Fredericksburg and Washita rocks of the San Marcos Platform area	24
Edwards Group	24
Edwards—Glen Rose boundary	24
Kainer Formation	24
Person Formation	25
Person-Kainer boundary	25
Regional Dense Member	25
Person Formation undivided	25
Edwards-Georgetown boundary	25
Devils River Formation	26
Georgetown Formation	26
Del Rio Clay	26
Buda Limestone	27
Edwards-Georgetown relationship—facies or topography?	27
Edwards Group, eastern Edwards Plateau, Central Texas	29
Introduction	29
Stratigraphy	30
Edwards Group	30
Base of the Edwards	30
Fort Terrett Formation (new)	30
Basal Nodular Member (informal)	32
Burrowed Member (informal)	32
Dolomitic Member (informal)	34
Kirschberg Evaporite Member (emended)	34
Segovia Formation (new)	34
Burt Ranch Member (new)	35
Allen Ranch Breccia (new)	40
Gryphaea Bed (informal)	40
Orr Ranch Bed (informal)	42
Black Bed (informal)	42
Del Rio Clay and Buda Limestone	43
Top of the Edwards	43
Lateral stratigraphic relations	46
Surface-subsurface stratigraphic relations	47
Depositional environments	50
Shallow-water depositional model	50
Fredericksburg and Washita depositional environments	50
Open deep marine	50
Open shelf	52
Open shallow marine, moderate to high-wave energy	52
Open shallow marine, low-wave energy	52
Restricted shallow marine	52
Tidal flat	52
Euxinic, evaporitic shelf-basin	53
Evaporite-dominated supratidal flat	53
Coastal terrigenous	53
Formation of clinoforms	54
Diagenesis of Edwards Group	54
Collapse structures	55
Dolomite	57
Introduction	57
Classification and origins	57
Stratal dolomite	57
Massive-bioclastic dolomite	57
Massive-muddy dolomite	57
Fissure-filling dolomite	58
Dolomite distribution, porosity, and faulting	59
Crystalline limestone	59
Crystalline limestone and collapse zones	59
Microspar	59
Pulverulite	60
Porosity and permeability	60
Subsurface	60
Surface	61
Synthesis	62
Influence of the Central Texas Platform	62
Depositional history	62
Introduction	62
Fredericksburg time	66
Early Washita time	70
Late Washita time	71
Conclusion	71
References	72
Appendices	108
A. Well index	108
B. Core descriptions	113
C. Measured sections	137
D. Localities	190
E. Type logs, Person and Kainer Formations	194
F. Fredericksburg-Washita relationships in the Maverick basin	196
G. Quantitative analysis of reflux hypothesis for dolomitization of massive-muddy Edwards dolomites	198

ILLUSTRATIONS

FIGURES— PAGE

1. Regional elements and areas of investigation . 4
2. Regional Fredericksburg-Washita elements, Central Texas 5
3. Regional structure, approximate top of Lower Cretaceous 6
4. Structure on base of Edwards Group . . . 8
5. Structure on base of Dr. Burt zone 9
6. Washita-Fredericksburg sequence. A, North Texas. B, Subsurface San Marcos Platform area 12
7. Schematic stratigraphic cross section, Fredericksburg and Washita rocks, north-central Texas 15
8. Fredericksburg and Washita stratigraphic relations. A, Subsurface of north-central Texas. B, Between Maverick basin and San Marcos Platform, south-central Texas 16
9. Generalized columnar section, Fredericksburg Division, Fashing-Person trend, south-central Texas . . . . . In pocket
10. Generalized columnar section, Washita Division, Fashing-Person trend, south-central Texas . . . . . In pocket
11. Stratigraphic cross sections of the Person Formation from the Karnes trough onto the upthrown block to the southeast showing lateral changes in beds 21
12. Stratigraphic cross section of the Person Formation along the Fashing-Person trend showing lateral changes in beds 22
13. Stratigraphic cross section showing unconformities and thickness changes in Washita stratigraphic units between the Karnes trough and the DuBose Field fault block 23
14. Isopachous map of Kainer Formation and equivalent rocks . . . . . In pocket
15. Isopachous map of Person Formation and equivalent rocks . . . . . In pocket
16. Isopachous map of Georgetown Formation and equivalent rocks . . . . . In pocket

FIGURES— PAGE

17. Isopachous map of Del Rio Clay . . . . In pocket
18. Isopachous map of Buda Limestone . . In pocket
19. Relations of Edwards and Georgetown. A, According to Tucker. B, Interpretation preferred by Rose 28
20. Subcrop map showing rock units underlying the Edwards Group 31
21. Isopachous and dolomite-percentage map, Fort Terrett Formation 33
22. Generalized columnar section, Fort Terrett Formation, eastern Edwards Plateau, Central Texas . . . . . In pocket
23. Isopachous and dolomite-percentage map, Segovia Formation 36
24. Generalized columnar section, Segovia Formation, eastern Edwards Plateau, Central Texas In pocket
25. Panel diagram showing limestone-marl relations within the Burt Ranch Member and distribution of bored surfaces 38
26. Isopachous and particulate limestone-percentage map, Burt Ranch Member 39
27. Map showing thickness distribution of interval: base Burt Ranch—*Gryphaea* Bed, pinchout of *Gryphaea* Bed, and distribution of Allen Ranch Breccia 41
28. Isopachous map of interval: Black Bed—top Segovia Formation 44
29. Isopachous map, Del Rio Clay 45
30. Summary of surface-subsurface stratigraphic relations, Edwards Group, Central Texas . . 49
31. Typical Edwards tidal flat cycle 49
32. Generalized Fredericksburg and Washita facies progressions across the subsurface San Marcos Platform, Central Texas 63
33. Regional stratigraphic cross sections . . . 64
34. Fredericksburg-Washita correlation chart . . 65
35. Layer maps showing distribution of Fredericksburg-Washita facies tracts 67-69

PLATES— PAGE

1. Geologic map of eastern Edwards Plateau, Texas . . . . In pocket
2. Regional base map, Edwards Group of Central Texas . . . In pocket
3. Subsurface correlation sections . . . . . In pocket
4. Stratigraphic cross sections . . . . . In pocket

5-19. Thin sections, core slabs, acetate peels 78-107

TABLES

TABLES— PAGE

1. History of Comanchean stratigraphic terminology 13
2. Classification of depositional environments 51

EDWARDS GROUP, SURFACE AND SUBSURFACE, CENTRAL TEXAS

Peter R. Rose[1]

ABSTRACT

In the subsurface of south-central Texas the Lower Cretaceous Edwards Group consists of about 400 to about 600 feet of porous dolomite and limestone that accumulated on the Comanche shelf as shallow marine, intertidal, and supratidal deposits in the lee of the Stuart City Reef. The Edwards thickens southwestward to about 1,000 feet near the Maverick basin and thins northeastward, by basinward thinning and facies change, to zero in the North Texas—Tyler basin. In between, on the San Marcos Platform, it is separated into the Kainer Formation (new) below and the Person Formation (new) above by a thin, widely traceable argillaceous layer called the Regional Dense Member (informal), the base of which is the conformable Person-Kainer boundary. The Edwards is conformable with the Glen Rose Formation below and disconformable with the Georgetown Formation above. The overlying Georgetown, Del Rio, and Buda Formations consist chiefly of argillaceous lime mud and represent marine open-shelf deposition. To the northeast the Kainer grades into the classic Walnut/Comanche Peak/Edwards sequence of the North Texas type area, and the Person grades into the lower Duck Creek Member of the Georgetown. To the southwest the Kainer and Person Formations pass into the Devils River Formation.

At the surface in the eastern Edwards Plateau of Central Texas the Edwards Group consists of about 400 to about 650 feet of dolomite and limestone similar to that of the subsurface Kainer and Person Formations; it thickens southward from the Central Texas Platform and grades into rudist limestone of the Devils River Formation. The Edwards is divided into the Fort Terrett Formation (new) below and the Segovia Formation (new) above, separated by a widely traceable marly interval, the Burt Ranch Member (new), at the base of the Segovia. The Glen Rose—Edwards, Edwards—Del Rio, and Del Rio—Buda boundaries are disconformable, but the Fort Terrett—Segovia boundary is conformable. The Georgetown is absent, probably by facies change into Edwards-type rocks, and the thin Del Rio and Buda Formations consist of fine-grained marine open-shelf deposits. Southeastward across the Edwards Plateau the Burt Ranch Member acquires miliolid and rudistid limestone at the expense of marl so that only a thin marly layer remains at the top as the Edwards goes into the subsurface; this is the Regional Dense Member.

Fredericksburg and Washita rocks in Texas represent nine major depositional environments, which were controlled by circulation patterns of marine waters, water depth, and terrigenous material in sea waters. Each environment can be recognized in the rock record by a combination of mineralogy, faunal content, sedimentary structures, and tectonic setting. The nine environments are: open deep marine; open shelf; open shallow marine, moderate to high-wave energy; open shallow marine, low-wave energy; restricted shallow marine; tidal flat; euxinic evaporitic shelf basin; evaporite-dominated supratidal flat; coastal terrigenous.

Dolomite is confined chiefly to restricted shallow marine, intertidal, and supratidal deposits, which were controlled chiefly by positive tectonic elements and areas of restricted circulation in the interior of the platform. Collapse breccias originated by solution and removal of gypsum shortly after deposition and during the Pleistocene and Holocene. Crystalline limestone is related to Cretaceous exposure, present weathering, and alteration of dolomite beds beneath dissolving gypsum. Pulverulite is related to contemporary weathering. The subsurface Edwards is more porous and permeable toward the top, as a result of early exposure of mobile fault blocks and the unconformity at the top of the group. The surface Edwards is porous throughout, but cavernous porosity and permeability at the base produce a widespread, effective aquifer. Ground water probably is enhancing porosity now.

From northeast to southwest, Edwards and equivalent units form two complete carbonate facies complexes. The lower (Fredericksburg) complex reflects extremely shallow water, high salinities, and low subsidence rates. The upper (Lower Washita) complex is a facies assemblage more like the standard carbonate model, with low-angle clinoforms along the subsiding basin margins and increasing dolomite toward the interior of the Central Texas Platform. Rate of subsidence was

[1] Shell Oil Company, Denver, Colorado.

the chief factor controlling the formation of clinoforms. Upper Washita open-shelf units filled in and then blanketed Lower Washita topography.

Through Fredericksburg and Washita time, facies tracts retreated onto higher parts of the Central Texas Platform as it was progressively inundated during deposition of three units of successively deeper-water sediments.

INTRODUCTION

A thick sequence of Lower Cretaceous limestone and dolomite, known traditionally and informally as "Edwards," covers much of west-central Texas and composes one of the dominant physiographic elements of the State, the Edwards Plateau. In this region the base of the Edwards is an important fresh-water aquifer. Along the inner edge of the Gulf Coastal Plain, in the Balcones fault zone, the Edwards is also exposed but severely faulted and altered by ground water. South and east of the Balcones fault zone these same rocks dip gently gulfward beneath the coastal plain. Here the Edwards is an important target for oil exploration, with nearly 400 million equivalent barrels of oil and gas located or produced to date. Stratigraphic relationships between the subsurface Edwards of this area and the Edwards of the eastern Edwards Plateau have never been securely established.

The purposes of this report are (1) to delineate the stratigraphic framework of Edwards and associated rocks in the areas of the coastal plain and eastern Edwards Plateau; (2) to relate this framework with other work to the northeast and southwest; (3) to use the resulting regional framework to reconstruct a generalized paleogeography and depositional history of these rocks in Texas; and (4) to outline and explain the several diagenetic processes that have affected Edwards rocks.

REGIONAL GEOLOGIC ELEMENTS

Lower Cretaceous rocks in Central Texas were deposited on a vast, flat, generally submerged plain here called the Comanche shelf (figs. 1, 2), which covered most of the State except for the present southeast margin of the Gulf Coastal Plain. Deeper water lay to the southeast in the ancestral Gulf of Mexico basin. During deposition of the Edwards the seaward margin of the Comanche shelf was a long, narrow, bioclastic belt passing from Mexico into Texas in Webb County and bearing generally northeasterly across the State, the Stuart City Reef (Winter, 1961b). This linear belt, composed largely of rudist, coral, and algal debris, was probably ridge-like, for the first four stratigraphic units above the Edwards thin from the Comanche shelf over the Stuart City Reef and thicken again into the ancestral Gulf basin. Seaward of the Stuart City Reef water depth apparently increased abruptly, so that open-marine carbonate sediment accumulated in water hundreds of feet deep (Van Siclen, 1958, p. 1912; Winter, 1962, p. 84; Rose, 1963, fig. 4). On the Comanche shelf, however, water was generally quite shallow, although there were broad depressions and swells in the interior of the shelf that exerted great influence on thickness and lithology of Lower Cretaceous stratigraphic units. The two dominant depressions were the Maverick basin (Winter, 1962, p. 85) on the southwest and the North Texas—Tyler basin (Fisher and Rodda, 1967, fig. 1) on the north and northeast. Separating these two depressions was a broad elongate swell, the Central Texas Platform, bearing southeasterly from the vicinity of San Angelo across the Llano Uplift to the Stuart City Reef. Its southeastern end is known as the San Marcos Platform (Adkins, 1933, p. 266).

REGIONAL STRUCTURE

Structure contours on the top of the subsurface Lower Cretaceous arc gently around the San Marcos Platform (fig. 3). The top of the Lower Cretaceous dips southeast at about 300 to 400 feet per mile (3 to 4 degrees) (Zink, 1957). This gently bent monocline is interrupted by long antithetic and synthetic systems of en echelon normal faults. The dominantly synthetic Balcones fault zone forms the inner edge of the Gulf Coastal Plain and is the coastward limit of Edwards outcrop. According to Weeks (1945, p. 1734) total throw of the Balcones fault zone near Austin is about 900 feet and in northwestern Bexar County about 1,200 feet. Roughly 25 miles southeast and generally parallel is the antithetic Luling fault zone, of smaller length and throw (450 feet). Because the two fault zones appear to be part of the same tectonic system, they were probably mobile at the same time—middle and late Tertiary according to Murray (1961, p. 176). Isopachous and facies maps of Fredericksburg and Washita stratigraphic units show no deflections in the area of the Luling zone, and it therefore seems probable that no significant movement took place during deposition of those units, either along the Luling or the Balcones fault systems. The Luling, Salt Flat, and Darst Creek oil fields (Pl. 2) were formed where curved antithetic faults moved the porous, coastward-dipping Edwards reservoir against less permeable Upper Cretaceous limestone and clay.

On the southwest flank of the San Marcos Platform and about 30 miles farther down dip a very narrow system of synthetic-antithetic en echelon faults lies parallel to and about 15 miles northwest

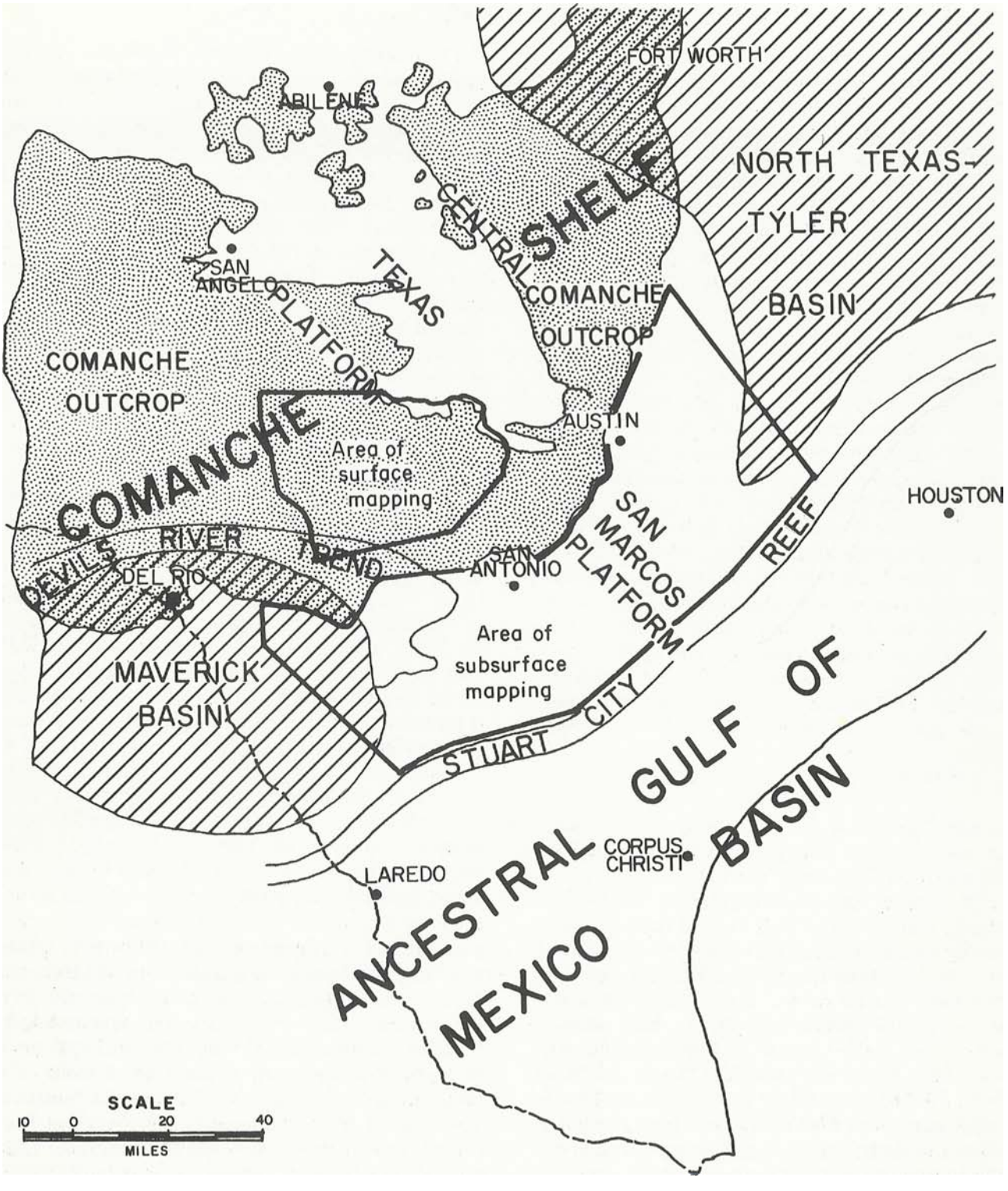

FIG. 1. Regional elements and areas of investigation.

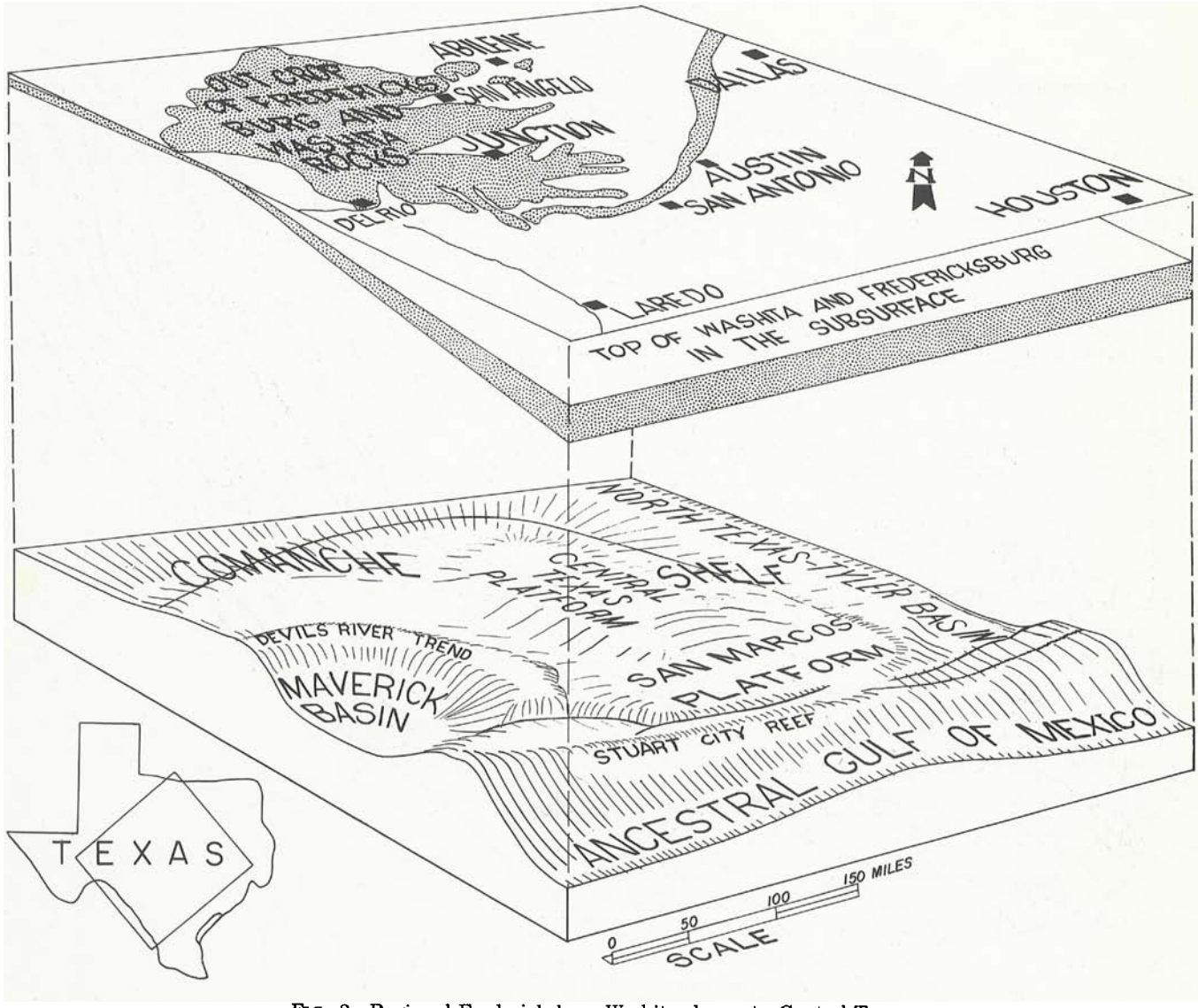

FIG. 2. Regional Fredericksburg-Washita elements, Central Texas.

of the Stuart City Reef. The synthetic fault zone is known as the Falls City fault zone; its opposite is here called the Person Field fault zone; together they form the Karnes trough (Tucker, 1965, 1968). Throw of both fault zones is approximately the same, 1,100 to 1,500 feet. The Fashing-Person series of oil and gas fields lies along the upthrown side of the antithetic Person Field fault. A similar structural feature branches off from the Karnes trough and passes westerly across Atascosa County; this is the Atascosa trough (modified after Newitt, 1962, p. 18). A series of oil and gas fields called the Charlotte-Pleasanton trend lies along the upthrown side of the antithetic fault system. The Mexia fault system, as described by Weeks (1945), appears to be present in south-central Texas as an ill-defined counterpart of the Atascosa trough, branching away from the Karnes trough in Gonzales County and passing into Northeast Texas. It will be shown (pp. 20-24) that depositional patterns of Edwards and later rocks were profoundly affected by these three troughs, which were actively subsiding during the later part of Early Cretaceous time. Furthermore, the Karnes trough has been intermittently active ever since (Eargle, 1959, p. 36), and the Atascosa trough and Mexia fault system have probably been active also.

Two other predominantly subsurface features in south-central Texas deserve comment. The Pearsall Arch is an elongate anticline that plunges west-southwest across Frio County into the eastern side of the Maverick basin. Although it appears to have

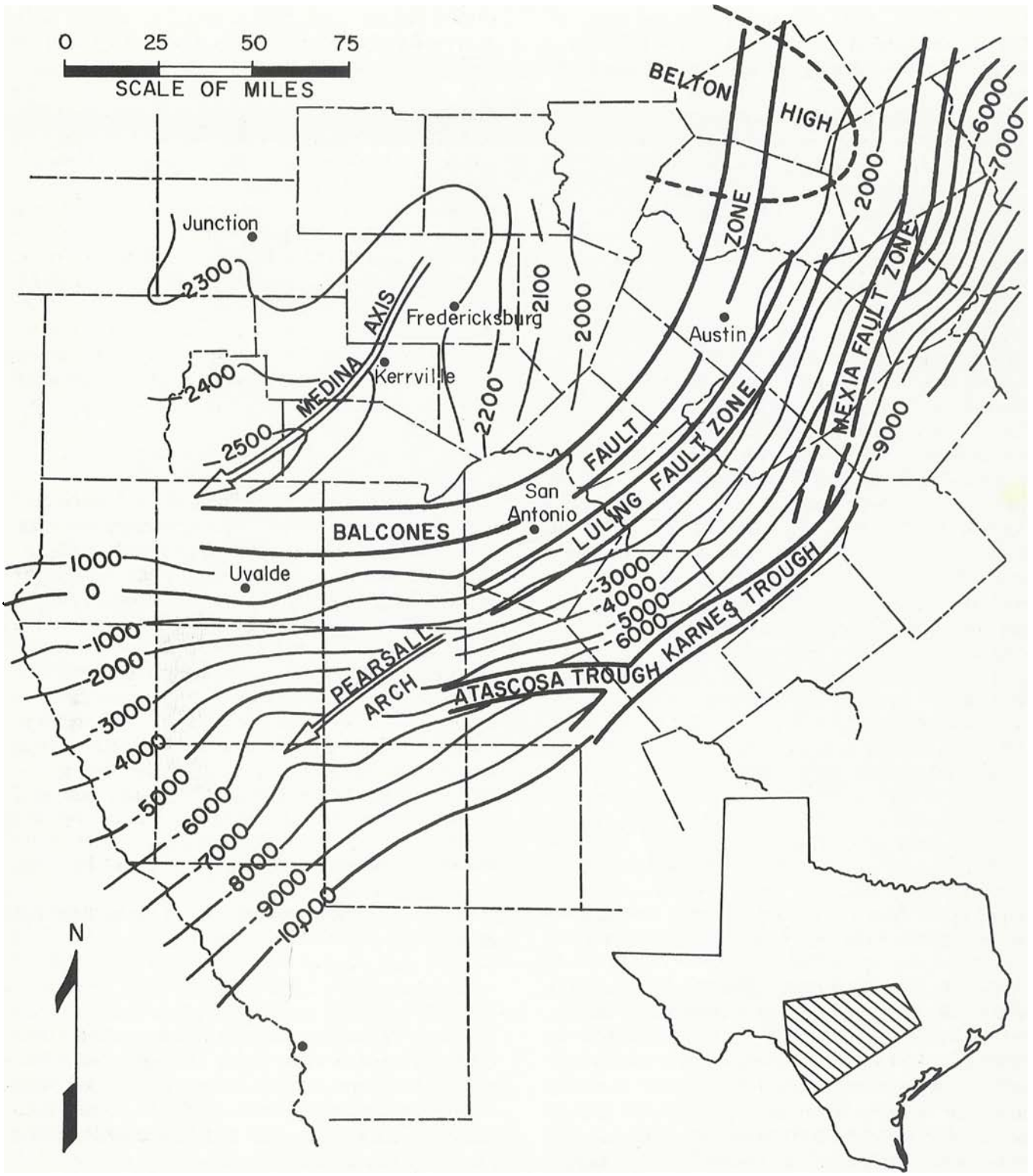

FIG. 3. Regional structure, approximate top of Lower Cretaceous. Modified after Zink (1957) and Tucker (1962a, 1967a).

been mobile during the Early Cretaceous it exerted only moderate influence on depositional patterns. The Belton high (Tucker, 1962b) is a subtle, broad positive feature roughly parallel to and about 80 miles north of the San Marcos Platform. Disconformities between Lower Cretaceous formations across the Belton high resulted from gentle positive movements. A few beds appear to pinch out on the flanks of the Belton high, but its influence did not rival that of the San Marcos Platform.

Formations in the eastern Edwards Plateau are essentially flat-lying and unfaulted except on its southeastern margins in the Balcones fault zone. Nevertheless, on a regional scale, distinct low-rank structural features are present, most of which were first recorded by Cartwright (1932).

Structure maps on the base of the Edwards and base of the Dr. Burt zone, a marker bed in the middle of the Edwards (figs. 4 and 5), show a positive axis that bears southwest from a broad domal area in central Gillespie County and extends across Kerr County to connect with the Devils River trend in western Bandera County. This is called herein the Medina axis; the name comes from the Medina River, which flows across it. Southeast of the Medina axis the base of the Edwards dips southeast at about 10 feet per mile, steepening eastward. To the northwest it dips north and west at about 5 feet per mile. A second, incompletely defined, positive feature present in western Kimble County is called here the Roosevelt high, after the nearby village. Between the Medina axis and the Roosevelt high is a broad, north-south synclinal area designated the Junction trough. It appears to bifurcate into southeast- and southwest-trending branches where Kimble, Edwards, and Kerr counties join. From the Medina axis eastward the upper part of the Edwards is eroded away and the "top Lower Cretaceous" mapping datum used in figure 3 must be estimated on the basis of lower mapping horizons within the group.

Isopachous mapping (Pl. 2) in the western part of the map area shows the Edwards Group to be a wedge that thickens southward from 400 feet to more than 650 feet as it approaches the Devils River trend. Largely because of this wedge-form, and because the resistant Edwards is the plateau-former, the top of the Edwards Plateau rises gently to the south before declining by erosion into the watersheds of the Frio, Sabinal, and Nueces Rivers.

All Edwards rocks accumulated in very shallow water. This fact, together with the wedge-form of the group, indicates greater subsidence in the southern part of the area, along the Devils River belt and the southern part of the Medina axis. But that is the very area that is now structurally high; apparently this area has been uplifted by perhaps 250 feet relative to the northern edge of the map area. It is tempting to relate this uplift to Balcones faulting, particularly in light of Meyerhoff's (1967, p. 1878) contention that the Gulf Coastal Plain did not move *down* along the Balcones fault zone but rather that the Edwards Plateau moved *up*. On the eastern side of the Plateau, however, Lower Cretaceous formations dip uniformly coastward approaching the Balcones fault zone from the west, so there may well be no connection whatever between the uplift and Balcones faulting. Whatever the origin of the uplift, it did not exist prior to the Cretaceous, for Walker's (1967) subsurface Paleozoic mapping in the Kerr basin shows no expression of either the Devils River belt or the Medina axis.

AREAS OF INVESTIGATION

This report deals with Edwards and associated rocks in two areas (fig. 1). The subsurface investigation is concerned with the San Marcos Platform, from the Maverick basin on the southwest to the margins of the North Texas—Tyler basin on the northeast (Pl. 2). The southeast boundary is the shelfward edge of the Stuart City Reef, and the northwest boundary is the Balcones fault zone.

The surface geologic investigation is confined to the eastern Edwards Plateau (fig. 1). The northern boundary is the Llano and North Llano Rivers, and the western boundary is an irregular line in the vicinity of the 100th meridian. The southern and eastern extent of mapping was limited by the absence of significant Edwards outcrop and by increasing structural complexities as the Balcones fault zone was approached.

No surface work was conducted in the Balcones fault zone.

METHODS

The subsurface investigation began with detailed examination of cores from the Fashing-Person trend of oil fields (*see* Appendix B). These cores were fitted together, slabbed (usually in a common plane), laid out, and etched with hydrochloric acid prior to examination. Core slabs, both wet and dry, were examined under the binocular microscope. Rock color was determined arbitrarily, but it is felt that the colors are fairly consistent, inasmuch as core slabs from different wells, described over a period of three years, were continually being com-

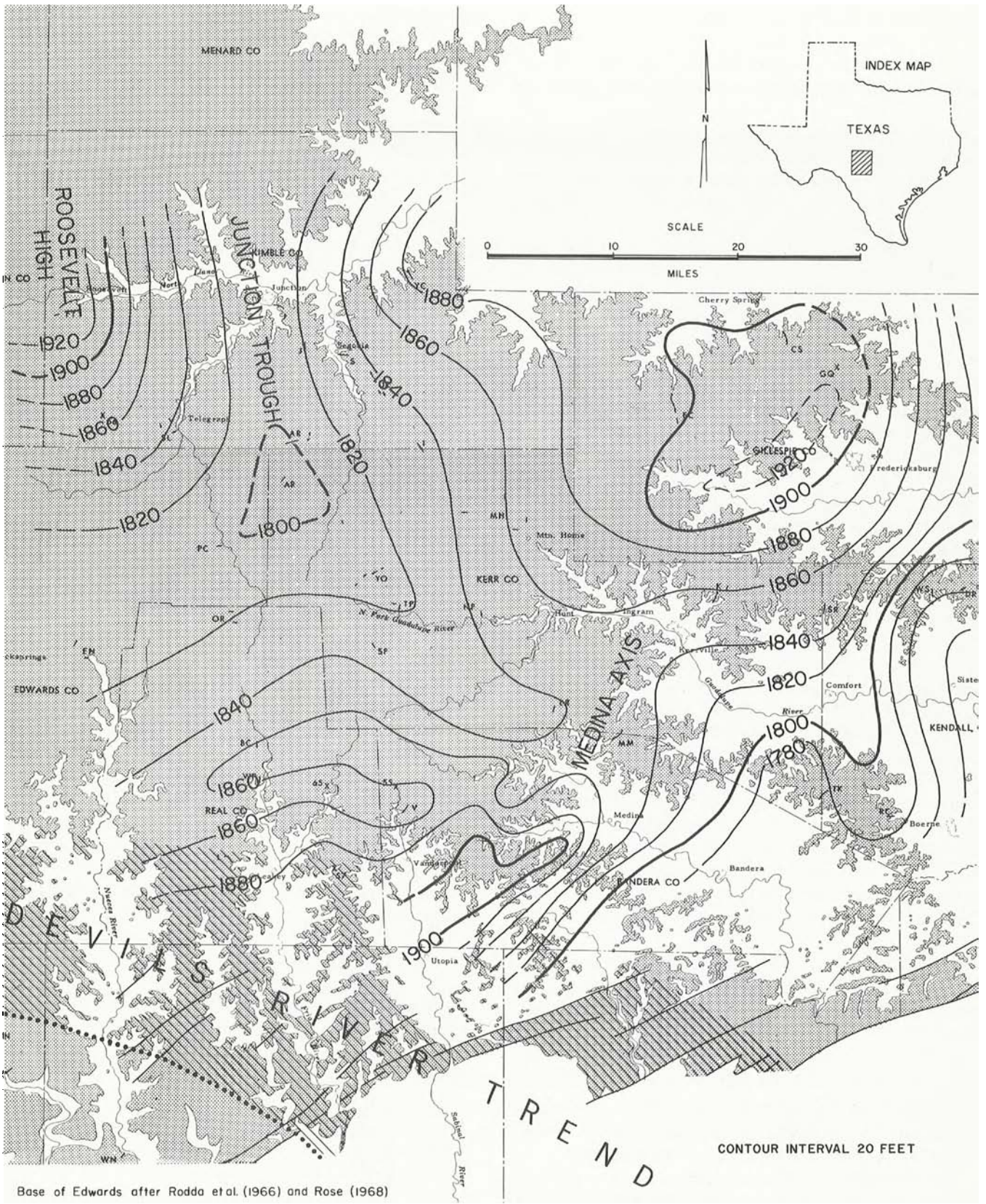

FIG. 4. Structure on base of Edwards Group. Elevations mostly from U. S. Geological Survey 7.5-minute topographic maps.

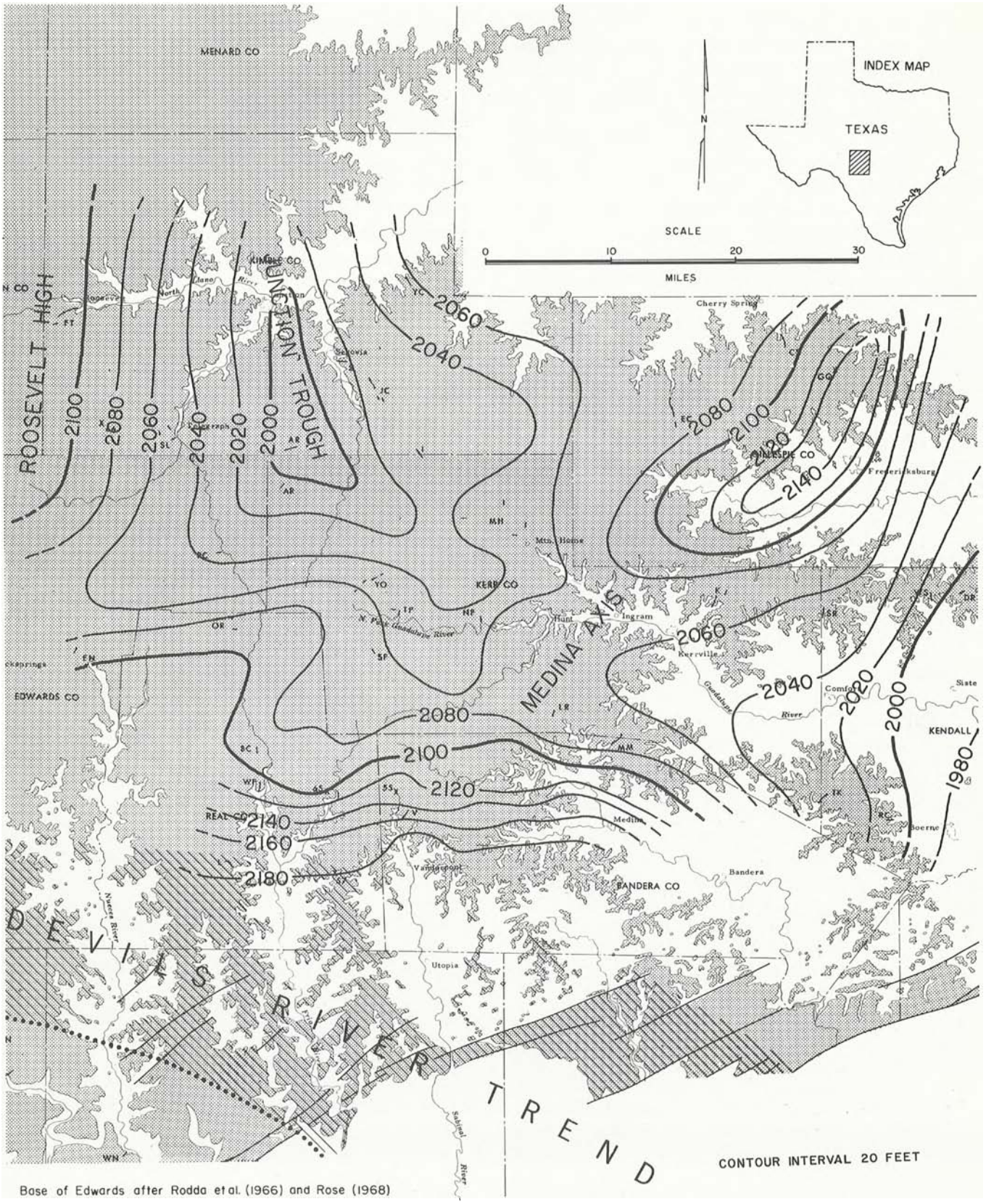

FIG. 5. Structure on base of Dr. Burt zone. Elevations mostly from U. S. Geological Survey 7.5-minute topographic maps.

pared. The classification of Archie (1952) was used to estimate porosity in subsurface cores and samples.

Primary textures were described in terms of Folk's (1962) classification, with the following modifications and additions:

(1) Folk's "poorly washed biosparite," used for skeletal limestones containing subequal amounts of sparry calcite and micrite, is replaced with "muddy biosparite" because it is less cumbersome and more descriptive.

(2) Muddy Edwards rocks frequently contain rounded sand-size particles of mud that have a composition almost identical to the matrix and whose peripheries, under high power, are gradational with the matrix. These grains are analogous to fecal pellets of modern carbonate sediments. Folk uses "pellet" to refer to very small (less than 0.20 mm), round allochems. Pellets of this study are grouped in the intraclast category and are referred to as "soft pellets"; rocks containing them are referred to as "pelleted." None of Folk's pellets were identified, but little thin-section work was done.

(3) Carbonate rocks are not described beyond five general texture types: micrite, dismicrite, biomicrite, muddy biosparite, and biosparite; such terms as "sparse or packed biomicrite" or "unsorted, sorted, or rounded biosparite" are not used.

(4) Condition of fossil fragments has been indicated by such terms as "whole-fossil biomicrite" and "mollusc-fragment biosparite."

(5) Degree of dolomitization has been indicated as follows:
   (a) dolomitic limestone: scattered dolomitic rhombs, original texture of limestone still readily discernible;
   (b) calcitic dolomite; proportion of dolomite to sparry calcite and/or micrite roughly 1:1;
   (c) dolomite: very little immediate effervescence or evidence of calcite; much original texture obliterated;
   (d) dolomitized: adjective describing rock consisting of more than 50 percent dolomite.

(6) Recrystallized micrite and biomicrite composed of rusty, brown, blocky calcite crystals, 20 to 50 microns in diameter, were called microspar in the core descriptions even though Folk (1959, p. 32) first used the term for smaller crystals—5 to 15 microns.

As a result of detailed core study a tentative stratigraphic sequence began to be recognized in the Fashing-Person trend. Next, cores (Appendix B) from wells throughout the San Marcos Platform were studied (Pl. 2), as well as ditch cuttings from other wells in the area.[2] By combining core and sample data with electric log correlations (Appendix A) a network of intersecting stratigraphic cross sections was constructed (Pl. 3).

The base map (Pl. 2) was constructed from 1:250,000 Army Map Service maps assembled and reduced to a scale of 1:500,000. Shell Oil Company allowed use of a regional map on which the location of all Edwards wells is shown, and key well locations were transferred to the base map. This base was then reduced for use in a series of surface and subsurface isopach and structure maps (figs. 4, 5, 14-18, 20, 23, 26-29).

It should be emphasized that the outcropping stratigraphic units recognized in this report have been physically traced from section to section. Twenty-four sections were measured, mostly in highway road cuts, using a Jacob's staff and hand level. Weathering profiles drawn at the outcrop were used in preparing the measured sections (Appendix C). Samples were collected every few feet, depending on rock variability, and were examined and described in as much detail as possible at the outcrop, using a hand lens. These specimens were sawed, etched, and re-examined in the laboratory under the binocular microscope as a further check.

ACKNOWLEDGMENTS

Deep gratitude is expressed to Dr. W. C. Bell who supervised this project and to committee members Dr. A. J. Scott and Dr. K. P. Young of The University of Texas at Austin and Dr. C. I. Smith of the University of Michigan. The moral and material support given by Mr. T. D. Cook, Shell Oil Company, and Dr. F. E. Lozo, Shell Development Company, is also gratefully acknowledged. Mr. V. J. Kennedy, Shell Oil Company, generously arranged for release of core descriptions, electric logs, and base maps from some previous work. The Tenneco, Standard of Texas, Humble, and Pan American oil companies all released data for use.

The following assisted in different ways and their help is gratefully acknowledged: Dr. V. E. Barnes, Mr. J. W. Macon, and Mr. D. F. Scranton, Bureau of Economic Geology, The University of Texas at Austin; Mr. Gerald Baum, Texas Water Development

[2] Although the locations are shown of wells for which ditch cuttings were examined, the sample logs are not included here, the core descriptions being deemed sufficient documentation. Nevertheless, the sample data were used in constructing lithofacies maps.

Board; Mr. Walter Bloxsom, Mr. J. B. Brown, and Mr. Reuben Arevalo, Shell Oil Company; Mr. Lyman Dawe, Pan American Petroleum Corporation; Dr. A. R. Palmer, State University of New York at Stony Brook; Mrs. Judy D. Rose.

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STRATIGRAPHY

HISTORY OF PREVIOUS INVESTIGATIONS AND NOMENCLATURE

Robert T. Hill (1887, 1891) was responsible for the three-part subdivision of the Cretaceous-Comanche Series of Texas into Trinity, Fredericksburg, and Washita Groups.[3] Most of Hill's early work was done along the outcrop belt from the Oklahoma border south to Austin, and the rock succession there became Hill's mental reference section. For the next 70 years the majority of published investigations of Fredericksburg and Washita rocks in Texas was carried out in that area. The results were that North Texas became the classic area for the Comanche; Trinity, Fredericksburg, and Washita gradually acquired time-stratigraphic connotations, and most geologists elsewhere in the State tried to fit equivalent rocks into the North Texas mold (fig. 6, A).

The history of Comanchean terminology has been treated at length by many authors (Adkins, 1933; Lozo and Stricklin, 1956; Lozo, 1959; Martin, 1961; Lozo and Smith, 1964) and will not be repeated here; table 1 shows, in stratigraphic order, the names now in use, who defined them, and where. The remainder of this section will concern itself with the history of important stratigraphic investigations of the Edwards and strata immediately involved with it.

The rock body now called Edwards was first called Caprina Limestone by Shumard (1860, p. 584) and subsequently Barton Creek Limestone by Hill (1889, p. 5). Both Caprina and Barton Creek were replaced by "Edwards Formation" (Hill and Vaughan, 1898a). The new name referred to the thick mass of resistant limestone composing the Edwards Plateau of Southwest Texas and generally included everything between the (Trinity) Glen Rose Formation and a thin, somewhat vaguely-referred-to veneer of Washita ("Fort Worth" and Del Rio) capping the Plateau. Following Hill and Vaughan, the name Edwards was thereafter applied

[3] In 1894 Hill adopted usage of Division rather then Group, implying that Trinity, Fredericksburg, and Washita were distinct and separate cycles of sedimentation and, thus, provincial time-stratigraphic units.

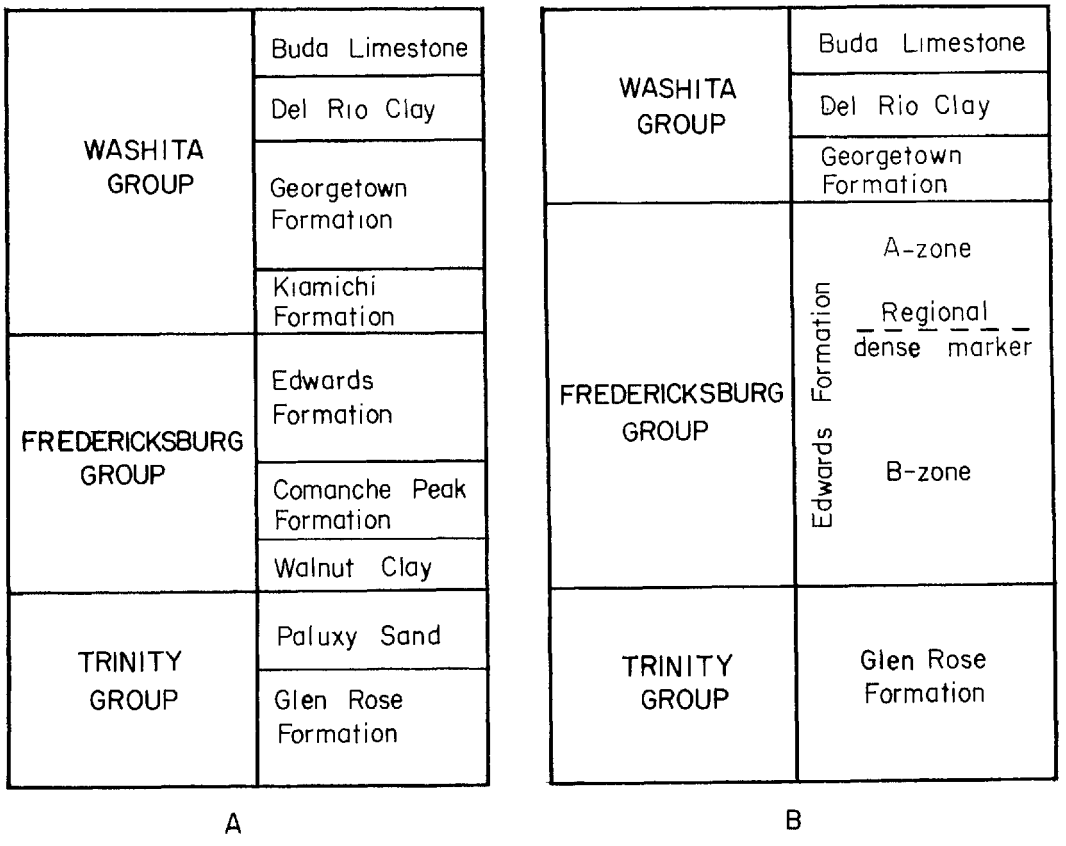


FIG. 6. Washita-Fredericksburg sequence. A, North Texas. B, Subsurface San Marcos Platform area.

in North and Central Texas to the caprinid-bearing resistant carbonate sequence below the Georgetown and above the Comanche Peak, in place of Caprina or Barton Creek. But conceptually, North Texas still remained the type area of the Edwards, despite its Southwest Texas place name.

TABLE 1. *History of Comanchean stratigraphic terminology.*

WASHITA DIVISION—
Named by Shumard (1860) from exposures near Fort Washita, Oklahoma, and subsequently modified by Hill (1887) in the Dallas—Fort Worth area. Hill later (1894) included both the Buda and Kiamichi Formations in the Washita.

Buda Limestone: First called Vola or Shoal Creek by Hill (1889) for exposures on Shoal Creek, Austin, Travis County, Texas, but not described until 1890 and replaced by Vaughan's (1900) term Buda because Shoal Creek was preoccupied.

Del Rio Clay: Named by Hill and Vaughan (1898b) for exposures near Del Rio, Val Verde County, Texas. The U. S. Geological Survey uses the North Texas term "Grayson Marl," named by Cragin (1894) for outcrops in Grayson County, Texas, in preference to Del Rio. Workers in the Texas Cretaceous have tended to use Del Rio in Central and South Texas and Grayson in North Texas.

Georgetown Formation: First used formally by Vaughan (1900) who gave Hill credit for the name. Type section is on the San Gabriel River near Georgetown, Williamson County, Texas.

Kiamichi Formation: Named by Hill (1891) for exposures near the Kiamichi River in Choctaw County, Oklahoma.

FREDERICKSBURG DIVISION—
Originally named by Hill in 1887 but emended in 1891 to make room for the Trinity at the base; type locality is Fredericksburg, Gillespie County, Texas.

Edwards Formation: See page 12.

Comanche Peak Formation: Named by Shumard (1860) and modified by Hill (1891). Type locality is Comanche Peak, an early landmark in Hood County, Texas.

Walnut Formation: Named by Hill (1891) for outcrops at Walnut Springs, Bosque County, Texas.

TRINITY DIVISION—
Used first by Hill (1889); name derived from Trinity River valley, north-central Texas.

Glen Rose Formation: First called Caprotina Limestone by Shumard (1860) and renamed by Hill (1891) for exposures along the Paluxy River near the town of Glen Rose, Somervell County, Texas.

A second name, Devils River Formation, was introduced by Udden (1907, p. 56) for what he thought was the same rock interval farther to the west.

Discovery of oil at Luling in 1922 promoted the extension of North Texas nomenclature southward into the area of the subsurface San Marcos Platform. The new reservoir was a thick, porous, fossiliferous limestone and dolomite formation underlying a limestone-shale-limestone sequence that was immediately recognized as Buda-Del Rio-Georgetown. Although there were some notable peculiarities in the San Marcos Platform succession (the Georgetown was quite thin, the Kiamichi was apparently absent, the Edwards was very thick, and the Comanche Peak, Walnut, and Paluxy were absent), most of the classic terminology could still be made to fit (fig. 6, B), and the old terms were perpetuated by numerous publications describing each new oil field in turn (Sellards, 1922, 1924; Pratt, 1923; Brucks, 1925; Row, 1929; Weeks, 1930; McCollum et al., 1930; McCallum, 1933; Bolinger, 1953; Knebel, 1956; Hendy, 1957; Knebel and Jones, 1957; Knapp, 1962; Lang, 1962). There was only one new development in Fredericksburg-Washita stratigraphy of the San Marcos Platform area: A thin, widely traceable, slightly argillaceous, compact limestone in the middle of the Edwards was recognized in the 1950s (*see* Van Siclen, 1958, fig. 10) and became the basis for separating the thick Edwards mass into an upper "A-zone" and lower "B-zone" (Winter, 1961a; Keahey, 1962). This thin bed became informally known as the Dense Bed (Knapp, 1962, p. 203) or Regional Dense Marker. Despite this subdivision, the essential lithic unity of the rock body called Edwards was well recognized; if a formation is a rock unit reflecting one genesis (in the broad sense), then the subsurface Edwards of the San Marcos Platform was a good formation.

Between 1922 and 1964 the stratigraphy of the classic North Texas area was undergoing further refinement in studies by W. M. Winton, Gayle Scott, W. S. Adkins, and others. Adkins (1924, p. 38) showed that in McLennan County the Georgetown could be divided into seven members, reading upwards: Kiamichi, Duck Creek, Fort Worth, Denton, Weno, Pawpaw, and Main Street. Later Adkins (1933) summarized and interpreted masterfully the known stratigraphic facts of the area. Subsequent surface investigations by Lozo (1949, 1959), Adkins and Lozo (1951), Shelburne (1959), Nelson (1959), and Moore (1964) added much knowledge about the physical stratigraphy and petrology, and paleontological work by Matthews (1951, 1956) and Young (1959a) clarified relations of Edwards rudist-bank faunas. Study of Washita ammonites by Young (1959b, p. 758) showed that:

(1) A clearly defined sequence of eight ammonite zones maintained approximate parallelism with Washita (Georgetown) rock units, indicating that the boundaries of those rock units

approach isochroniety;
(2) the ammonite zones become thinner toward the San Marcos Platform;
(3) each of the four lower zones is successively overlapped by the next younger zone as the Georgetown thins southward on the Edwards.

Figure 7 summarizes present concepts of Fredericksburg-Washita stratigraphic relations between Dallas and Austin.

An outgrowth of this foregoing North Texas work was the proposal (Lozo and Stricklin, 1956; Lozo, 1959) to return to the Division concept of Hill (1894). The Division, as envisioned by Lozo (1959, pp. 1, 18) is "an integrated sub-series representing a major and distinct cycle of sedimentation...distinct from the paleontologically defined *stage* and the cartographic, lithologically defined association of formations usually called a group." This concept was adopted by the majority of active Cretaceous workers in Texas, so that Trinity, Fredericksburg, and Washita are now widely accepted as provincial time-stratigraphic units.

Sporadic and scattered geologic mapping programs have been carried out, chiefly by oil company geologists, on the Edwards Plateau since 1922, and several such projects have provided significant references to reliable marker beds mappable over wide areas of the Plateau. In Val Verde County Calvert (1928) recognized near the top of the otherwise-indivisible Devils River Formation a persistent bench that was subsequently called "the Calvert Slope." Widespread mapping and the discovery of distinctive black limestone nodules in the Calvert Slope by Humble Oil & Refining Company in the 1950s have made it a reliable mapping horizon now well known as "the Black Bed." Curry (1934) mapped a persistent, resistant limestone ledge containing abundant *Gryphaea* shells through much of Kimble, Kerr, and Edwards counties; this marker is now known as "the *Gryphaea* Bed." It lies roughly 140 feet below the Black Bed. Barnes (1952-1967) mapped the Edwards along the south side of the Llano Uplift between 1939-1947 and recognized another important horizon in the middle of the Edwards, the Kirschberg Evaporite, which lies about 125 feet below the *Gryphaea* Bed. Robert Pavlovic, Mobil Oil Company, mapped in the eastern Edwards Plateau in the mid-1950s. In the middle of the massive limestone sequence he discovered a thin persistent marly zone containing a rich mollusc fauna, including scattered ammonites, mostly oxytropidoceroids, which Pavlovic called "the Dr. Burt ammonite zone" (Hazzard, 1959, p. 19; Lozo and Smith, 1964, p. 293; Young, 1966, p. 8). Since the late 1950s a series of ground-water surveys (Long, 1958, 1962; Welder and Reeves, 1962; Reeves and Lee, 1962; Reeves, 1967) have been carried out jointly by the Texas Water Commission and the U. S. Geological Survey in the southern Edwards Plateau. These reports led to the general adoption of the nonspecific term "Edwards and associated limestones" as an accurate reflection of the essential hydrologic and lithologic unity of the limestone and dolomite rock body between the Glen Rose and Del Rio or Buda (or Georgetown where clearly recognized).

Before 1961 there had been only two published attempts at regional synthesis of Fredericksburg and Washita stratigraphy that involved the subsurface. Imlay (1945) dealt with the entire Lower Cretaceous of South Texas on a very broad scale and reached a number of conclusions as to Fredericksburg and Washita stratigraphic relations, many of which have since been discarded. Zink's (1957) resume repeated most of Imlay's interpretations.

The first well-documented regional subsurface investigations involving the Edwards were carried out by Delos Tucker and Jan A. Winter, who investigated Fredericksburg and Washita stratigraphic relations on the northeast and southwest sides of the San Marcos Platform, respectively (fig. 8). Tucker (1962a, 1962b) showed that:

(1) The southward thickening of the Edwards (at the expense of the underlying Walnut and Comanche Peak Formations), already well described from Austin north by Adkins (1933), Lozo (1959), and Nelson (1959), also continued south of Austin, so that the entire Fredericksburg Division on the San Marcos Platform consists of the porous, particulate carbonate rock known as Edwards.
(2) The Kiamichi of North Texas could be traced south into the middle of the mass of Edwards, where it was known as the Regional Dense Marker (middle Edwards of Tucker).
(3) The upper, oil-producing part of the Edwards Formation on the San Marcos Platform (Edwards "A-zone" or "upper Edwards") occupied the same geometric position as the lower part of the Georgetown Formation of North Texas. To explain this Tucker interpreted a facies relation between lower Georgetown and "upper Edwards" whereby Edwards rock occurs at progressively higher stratigraphic levels going southward toward the platform.

Winter's (1961a, 1961b, 1962) main contributions had to do with the Stuart City Reef, but

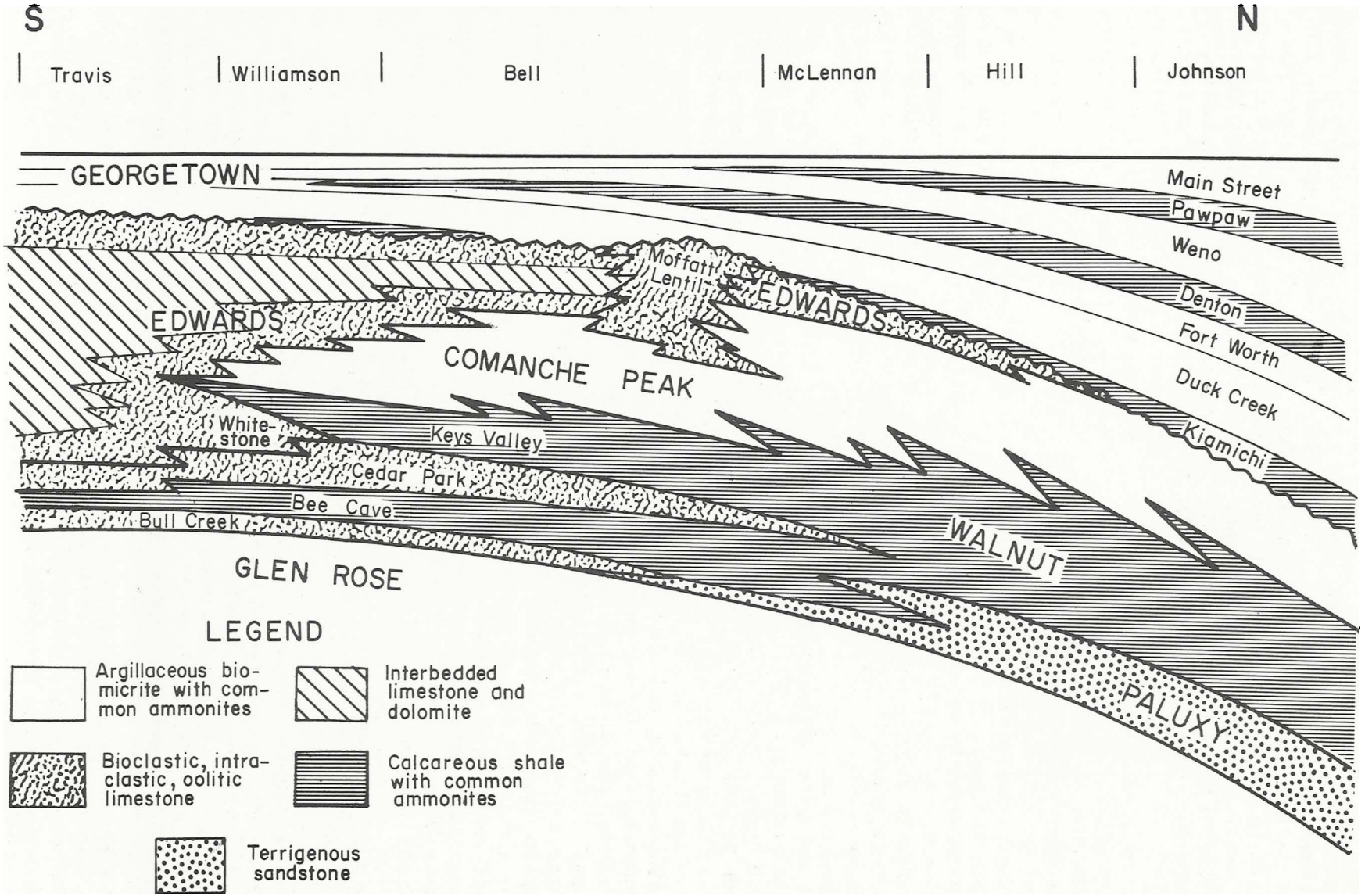


FIG. 7. Schematic stratigraphic cross section, Fredericksburg and Washita rocks, north-central Texas. Compiled from Adkins (1933), Adkins and Lozo (1951), Lozo (1959), Moore (1964), and Young (1959a).

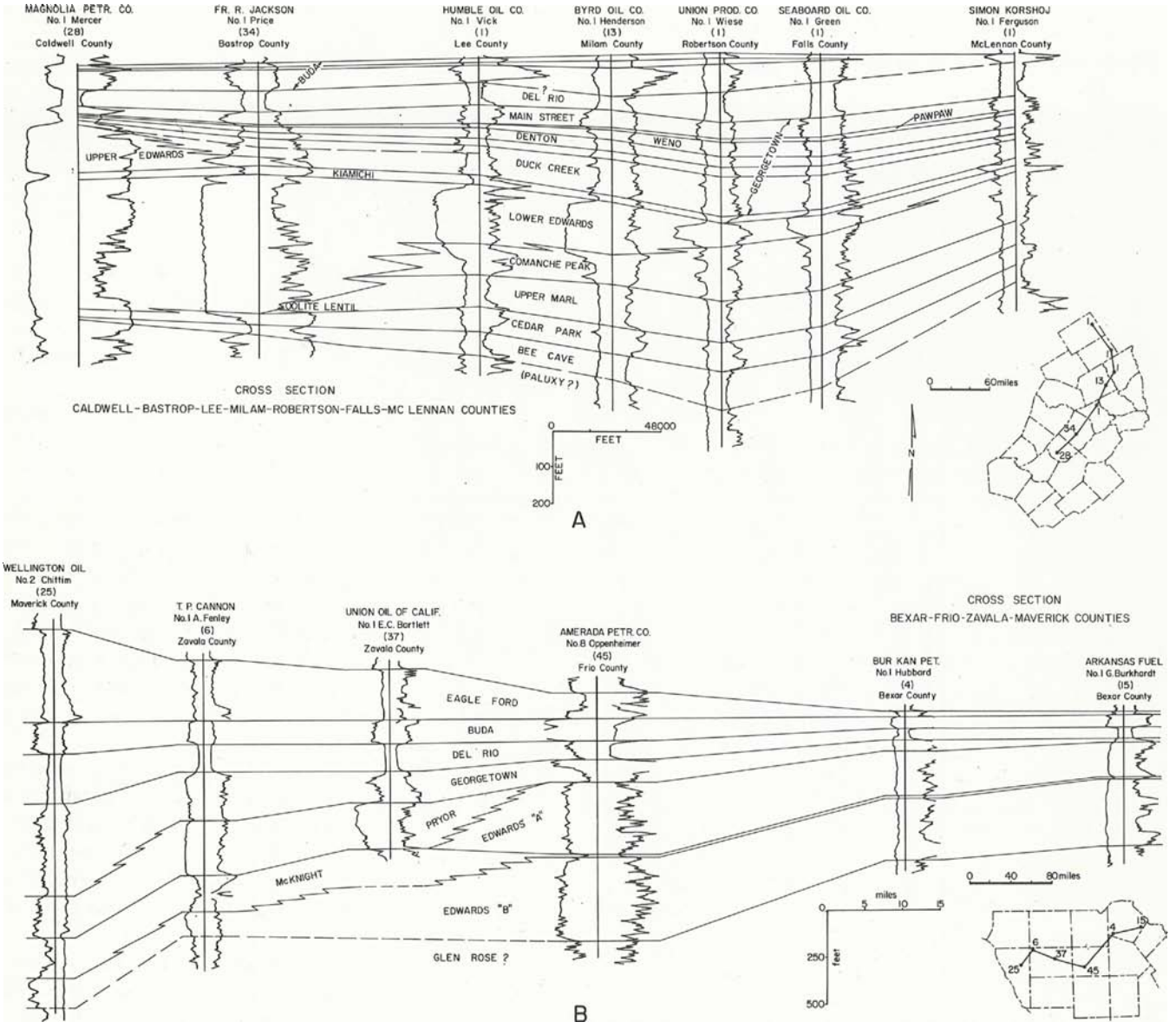


FIG. 8. **Fredericksburg and Washita stratigraphic relations. A, Subsurface of north-central Texas (from Tucker, 1962a, 1962b). B, Between Maverick basin and San Marcos Platform, south-central Texas (from Winter, 1962).**

relevant to this paper are the following:

(1) He defined and mapped the Maverick basin.

(2) He recognized that the black shaly limestone and anhydrite lithosome in the Maverick basin, called McKnight by oil-industry geologists since the 1940s, changes facies into the upper part of the Edwards "B-zone" and the Regional Dense Marker ("SP indentation" of Winter). The eastern boundary of the Maverick basin is coincident with the zone of facies change.

(3) The thick, compact micritic limestone above the McKnight and below the Del Rio in the Maverick basin, generally called Georgetown, consists of two units, separated solely on the basis of electric log character. The lower unit Winter called the Pryor Member, and he recognized that it changes facies into the much thicker "Edwards A-zone" on the San Marcos Platform to the east; the edge of the Maverick basin is again the belt of facies change.

Tucker and Winter did not present a synthesis of their work so as to connect across the San Marcos

Platform, and their electric log correlations were not sufficiently supported by core and sample data. Nevertheless, their published investigations were major contributions and have been heavily relied on by many geologists.

A recent summary by Rogers (1967) showed generalized distribution patterns of dolomite relative to the Stuart City Reef and attributed the dolomite to seepage refluxion à la Adams and Rhodes (1960).

Between 1957 and 1960 a program of surface mapping and stratigraphy was conducted by Shell Development Company along the southern margin of the Edwards Plateau and the northern edge of the Maverick basin, mostly by F. E. Lozo and C. I. Smith (1964). Important findings relative to the present paper are as follows:

(1) Lozo and Smith showed that, contrary to Imlay and others, the McKnight crops out in the southern reaches of the Edwards Plateau.
(2) New names for the old Maverick basin sequence of formations were formally proposed: The old sequence Edwards-McKnight (or Kiamichi)-Georgetown became West Nueces-McKnight-Salmon Peak.
(3) Udden's old term "Devils River" was formally restricted to a belt bordering the north rim of the Maverick basin in which bioclastic Fredericksburg and Washita rocks are inseparable.
(4) Lozo and Smith demonstrated that in the western Edwards Plateau the Fredericksburg-Washita sequence north of the Devils River belt could be divided into two unnamed units separated by a disconformity immediately below the Dr. Burt zone.

Papers by Young (1966), Moore (1967), Fisher and Rodda (1967, 1969), and Frost (1967) are the most recent significant contributions. In addition to the taxonomy of the Fredericksburg ammonites, Young presented a thorough treatment of Fredericksburg biostratigraphy. Many of his specimens were collected on the Edwards Plateau, and his results will take on even more meaning when the rock relations are firmly established.

Moore traced the lower part of the Fredericksburg Division west from the North Texas type area into the northernmost part of the Edwards Plateau and then traced these beds south into the lower unnamed formation of Lozo and Smith. Conclusions relevant to this report are:

(1) A southeast-trending linear lime-grainstone and rudist-bioherm barrier, about 20 miles southwest of Abilene, was the dominant factor in producing a very shallow lagoon to the southwest in which predominantly tidal-flat dolomite was deposited.
(2) The Walnut—Comanche Peak sequence of the North Texas outcrop belt does not persist south and west of the linear grainstone belt.
(3) The term Edwards Formation should be applied throughout the Edwards Plateau, south to the Devils River Formation, for all rocks above the Trinity, Paluxy, or Antlers *and below the Dr. Burt zone.*

Fisher and Rodda (1967, 1969) summarized the relations between Edwards stratigraphy and the distribution of evaporite, dolomite, chert, and limestone types; their more pertinent conclusions relative to this report are:

(1) The Dr. Burt zone and the Regional Dense Marker of the subsurface are equivalent, and both are entirely continuous with the Kiamichi Formation.
(2) Edwards dolomite is concentrated around the Llano Uplift and San Marcos Platform. It is limited on the north by a series of barriers similar to Moore's grainstone barrier, on the south by the Devils River belt, on the east by the Stuart City Reef, and on the west by deeper water of the Comanche shelf. It decreases regularly away from the Llano Uplift in all directions.
(3) Edwards dolomite is of three general classes: massive, stratal, fault-and-fracture; most dolomite north of the San Marcos Platform is the massive type, related to early replacement of skeletal banks by seepage refluxion, whereas most to the south is of the stratal variety, related to tidal-flat-type dolomitization.
(4) The "Kirschberg Lagoon" was an oval, shallow restricted shelf-lagoon, roughly coincident with the Central Texas Platform, in which accumulated alternating evaporites and shallow-water lime mudstone and grainstone. It did not extend far into the present subsurface.
(5) Surrounding the Kirschberg Lagoon is a series of concentric belts in which lime mud decreases outward progressively, and clastic limestones increase.
(6) Chert and dolomite are frequently associated, and there is close agreement between regional high concentrations of dolomite, chert, and the Kirschberg Evaporite of Barnes.

Frost (1967) showed that on the north side of the Central Texas Platform, the Edwards consists of three facies (reef, patch-reef dolomite, and back-reef dolomite) that built northward through Fredericksburg time. He suggested that the back-

reef facies was dolomitized as a result of hypersaline lagoon conditions.

RECOMMENDED STRATIGRAPHIC NOMENCLATURE

In this report "Edwards" is treated as a group, consisting of two formations in south-central Texas, Kainer and Person (pp. 18, 19), and two formations in the eastern Edwards Plateau, Fort Terrett and Segovia (pp. 30, 34). The reasons for the rank changes are two:

(1) The Kainer, Person, Fort Terrett, and Segovia each contain significant rock units which must be called members, not beds, because of their thickness and vertical variability. Accordingly, the units comprising them (Kainer, Person, etc.) must rank as formations constituting yet a larger unit, the Edwards Group. In addition, the Segovia contains thin mapping units which are best described as key beds.

(2) A name is badly needed to refer to the entire mass of resistant, light-colored, porous, shelly, cherty limestone and dolomite above the Glen Rose and below the Kiamichi, Georgetown, Del Rio, or Buda. Use of the Edwards in this way—the original meaning of Hill and Vaughan—is consistent with the accepted concept of a group as a rock unit, rather than a time-rock unit, and is compatible with current (and ineradicable) usage by quarrymen, well drillers, foundation engineers, ground-water specialists, and most surface and subsurface geologists (who are not stratigraphic specialists).

North of Colorado River the Edwards should retain its present formational rank.

SUBSURFACE EDWARDS GROUP OF SOUTH-CENTRAL TEXAS

Fredericksburg-Washita Stratigraphy of the Fashing-Person Trend

The Fashing-Person trend is a linear series of oil and gas fields that produce from a porous limestone and dolomite rock body of Fredericksburg and Washita age, known traditionally as "Edwards." The trend lies parallel to and about 15 miles northwest of the Stuart City Reef, passing from Atascosa County across Karnes County into Gonzales County. It includes nine fields: Fashing, Hysaw, Big John—Panna Maria, Person, Labus, Davy, DuBose, Cheapside, and Austin Pierce (Pl. 2). Eight of the nine fields lie on the coastward, upthrown side of the Karnes trough (p. 5). The first and largest field, Fashing, was discovered in 1956, and active drilling continued in the trend until 1964.

The stratigraphy of Edwards and associated rocks in this area is here treated in detail because extensive core, sample, and electric log control makes clear many relations heretofore unsuggested or unproved. These relations will then be applied to the same rocks throughout the area of the San Marcos Platform, where control is more sparse.

EDWARDS GROUP

Edwards—Glen Rose Boundary

In the only described core that spans the Edwards—Glen Rose contact (Lone Star No. 1-A Tom, Fashing Field, Atascosa County, well index no. 5), the boundary is a transition downward from dark-brown dolomitic mollusc-fragment and miliolid biomicrite into dark-gray compact argillaceous anhydritic dolomitic micrite. Cuttings from other wells in the area suggest a similar lithic transition. The boundary used for mapping is basically an electric log correlation surface within this transition that can be traced updip into the more easily identified Edwards—Glen Rose boundary of the shallow subsurface in Travis County (Tucker, 1962b, pp. 196, 199). It is the least reliable of the mapping boundaries used in this report.

Kainer Formation (New)

In place of the nomenclatorially unacceptable "Edwards B-zone," the new term Kainer Formation is proposed. Type section is the core from Shell No. 2 Charles Kainer, Person Field, Karnes County, Texas, well index no. 3, from 10,791 feet to 11,193 feet, described in Appendix B. The complete core contains the upper boundary of the new formation but stops roughly 40 feet above the lower boundary. Shell Oil Company has placed the core on open file in their Houston sample warehouse.

The Kainer Formation is roughly 450 feet thick in the Karnes trough and thins to about 400 feet or less on the upthrown blocks to either side. It consists of two informal units, the Dolomitic Member below and the Grainstone Member above. Generalized rock descriptions are shown on figure 9 (in pocket) and except for emphasis will not be repeated in the text.

The term Kainer should be applied at the outcrop in the Balcones fault zone and in the subsurface to the southeast, southwest of the Colorado

River, northwest of the Stuart City Reef, and east and southeast of the Maverick basin.

Dolomitic Member (informal).—This is a lithically diverse unit about 260 feet thick that could probably be subdivided if more core data were available. The number of limestone interbeds decreases upwards so that the upper part of the member is almost entirely fine crystalline dolomitic micrite or dolomite (Pl. 5, A). Most of the dolomite is massive, rather homogeneous, and fine crystalline, but stromatolitic dolomite crusts (Pl. 5, B), collapse breccia (Pl. 17, B, D), and layers of crystalline celestite occur near the top of the member. The crusts are analogous to supratidal hard crusts reported from Andros Island (Shinn, Ginsburg, and Lloyd, 1965). Individual collapse breccias range in thickness from 1 to 10 feet. The celestite may be a diagenetic product arising from the solution and removal of gypsum and/or anhydrite layers, the strontium having been released during conversion of aragonite to calcite or dolomite. The upper boundary of the Dolomitic Member, based on the highest occurrence of thick beds of dolomite, is ordinarily transitional.

Grainstone Member (informal).—Well-sorted, medium-grained lime sand containing abundant miliolids (Pl. 5, C) and coated or composite clasts (Pl. 5, D) is characteristic of this unit; horizontal current streaks and low-angle planar crossbeds are common. The origin of the clasts is open to speculation—they may be analogous to the grapestone of Illing (1954) or they may be altered (weathered?) intraclasts derived from the Stuart City Reef. There are scattered layers rich in rudist shells. The Grainstone Member is about 120 to 140 feet thick, with scattered thin dolomitic streaks in the lower 40 to 50 feet.

The gross lithology of this member is homogeneous vertically and laterally, and electric log correlations within it are generally unreliable. Furthermore, despite the difference in carbonate rock types, the boundary between the Grainstone and Dolomitic Members is not well expressed on most standard electric logs.

Person Formation (New)

The new term Person Formation is proposed to replace the old Edwards "A-zone." The name comes from Person Field, and the type section is the core from the Standard of Texas No. 1 Wiatrek, Person Field, Karnes County, Texas, well index no. 10, from 10,775 to 11,002 feet. This is a nearly complete slabbed core that contains the upper boundary of the formation but stops about 8 feet short of the lower boundary. The core is described in Appendix B; it has been placed on open file in the Shell Oil Company sample warehouse, Houston, Texas, by permission of Standard Oil Company of Texas and Shell Oil Company.

The Person Formation is thickest in the Karnes trough (230 to 300 feet) and thinner on the upthrown blocks to northwest and southeast. It becomes progressively thinner toward the San Marcos Platform, from 250 feet at Fashing Field, to 225 feet at Person Field, to as little as 130 feet in the Austin Pierce area of Gonzales County. Figure 10 (in pocket) shows a generalized description of the Person succession; except to point out especially important features, it will not be further amplified here.

The intended area of applicability for "Person Formation" is the same as for the Kainer Formation.

Person-Kainer boundary.—Eight cores from the Fashing-Person area span this boundary, which is placed in a dark-gray, soft, granular, wispy, pyritic, carbonaceous zone 6 to 12 inches thick that contains abundant coated clasts and aggregates similar to those of the underlying Grainstone Member of the Kainer Formation (Pl. 6, A). The clasts are coarse to very coarse grained just above this "rotten zone," becoming smaller and fewer upward and ultimately disappearing about 8 feet above the contact. A discrete, irregular surface is present in two cores (Brazos No. 1 Person, Karnes County, well index no. 5, and Tenneco No. 1 Ullman, Gonzales County, well index no. 11) at the base of the "rotten zone" (Pl. 6, A). The lithology of the unit above the contact represents a change to calmer, more marine, and probably deeper depositional conditions from the shallow platform environment of the Grainstone Member.

Certainly there are features here that suggest disconformity. Nevertheless, no truncation of underlying beds or pinch-out of overlying ones can be demonstrated. Furthermore, the coated clasts may not have been reworked from the underlying Kainer Formation but may have come from the contemporaneously exposed Stuart City Reef to the southeast. Whatever its origin, the Kainer-Person boundary, lithically consistent and readily identified throughout the Fashing-Person area, is a superb correlation surface.

Regional Dense Member (informal).—This is the old Regional Dense Marker of subsurface use and the Middle (Kiamichi) Edwards of Tucker (1962b). It is traceable throughout the Fashing-Person trend and furnishes the basis for electric log subdivision

of the Edwards into Kainer and Person Formations. It consists of 20 to 25 feet of dark grayish-brown, compact, wispy, argillaceous micrite (Pl. 6, B, C) with scattered small oysters and fragile clams. The upper boundary is transitional. Lithology and thickness are essentially constant throughout the area. The Regional Dense Member is easily recognized in a core or from a good set of cuttings and ordinarily produces a distinct decrease in the S.P. curve that is offset by a peak in the resistivity curve.

Collapsed Member (informal).—This limestone and dolomite unit is characterized by a series of as many as eight (in Tenneco No. 1 Ullman, Gonzales County, well index no. 11) distinct collapse breccias, most of which are 1 foot or 2 feet thick but some as much as 5 feet thick. Many are quite spectacular (Pl. 17, D). These breccias commonly contain fragments of laminated dolomitized stromatolitic crusts that are analogous to the Andros Island hard crusts of Shinn, Ginsburg, and Lloyd (1965). A 10-foot interval of leached, highly porous dolomite is present in the lower part of the Collapsed Member, just below most of the breccias; this zone is the most consistently porous and permeable reservoir rock in the entire trend (Pl. 8, A). Thin beds of pelleted, dolomitized, mollusc biomicrite alternate with collapse zones near the top and become more prevalent toward the bottom of the unit. The Collapsed Member is 40 to 60 feet thick throughout the Fashing-Person trend.

Except for the Regional Dense Member, the Collapsed Member is the most consistent unit of the Person Formation in lithology, thickness, and electric log character. Unfortunately it is easily recognized only in cores: Collapse breccias cannot be detected from cuttings, and in addition, because the overlying unit is also dolomitic, neither can the upper boundary be determined from cuttings. In cores the upper contact is placed just above the highest distinct collapse breccia that occurs below a thick homogenous dolomite sequence. The S.P. curve is fairly consistent, particularly in the northeast half of the Fashing-Person trend, and the lower boundary is distinctive electrically and lithically, which allows the lower part of the Collapsed Member to be identified throughout the area.

Leached Member (informal).—Throughout the Fashing-Person area the Leached Member is a light grayish-brown, massive, homogeneous, finely porous, commonly burrowed, dolomitized biomicrite unit from 25 to 55 feet thick (Pls. 7, B; 8, C). Thin, spar-filled collapse structures and pseudomorphs after gypsum nodules and crystals are present near the top (Pl. 7, A). Much of the porosity is the result of preferential leaching of small mollusc-fragments (Pl. 7, B), and the Leached Member is one of the most prolific producing zones in the trend. Porosity commonly averages 12 to 15 percent, with permeability of 5 to 20 millidarcies. In the Karnes trough the Leached Member is less porous, containing a much higher proportion of shells and calcite cement, and appears to reflect accumulation in slightly deeper water (fig. 11).

From cuttings the Leached Member is logged as a dominantly dolomite interval, and the top of the dolomite is one of the more reliable boundaries in the Person Formation.

Marine Member (informal).—Coarse-grained cross-bedded, rudist biosparite and biomicrite compose the Marine Member (Pl. 7, C, D). Other characteristic lithic features are scattered black and brown replacement chert nodules, disseminated chalcedony, and general absence of dolomite. Common faunal constituents are listed in figure 10. Thickness of the member ranges from 40 feet to nearly 60 feet in Karnes County, but the member is thinner on upthrown fault blocks in Gonzales County (figs. 11, B; 13). In Karnes trough wells of Gonzales County, however, the Marine Member is fully developed. The upper boundary with the overlying Cyclic Member is transitional and cannot be recognized from cuttings, nor does the bed induce a distinctive pattern in electric log curves. Although porosity averages about 12 percent, permeability is poor because many pores are not connected.

Cyclic Member (informal).—The uppermost unit of the Person Formation is characterized by cyclic sequences of stromatolitic crusts and collapse breccias, disrupted intervals, apparent channel deposits, and burrowed pelleted micrite. All may be dolomitic (Pl. 8). In the Person Field area a 6-foot bed containing corals and a diverse rudist assemblage represents the only distinctly fossiliferous unit in an otherwise unfossiliferous muddy sequence. However, cores from wells in the Karnes trough indicate a slightly more marine aspect throughout. The Cyclic Member is about 115 feet thick at Fashing Field, about 60 to 70 feet thick at Person Field, 30 to 40 feet thick at Davy Field, and missing on the upthrown fault block farther to the northeast (fig. 12). As might be expected in so lithically diverse a unit, porosity and permeability are highly variable. Commonly, however, there are two or three thin intervals with porosity in excess of 12 percent and permeability of 5 to 10 millidarcies.

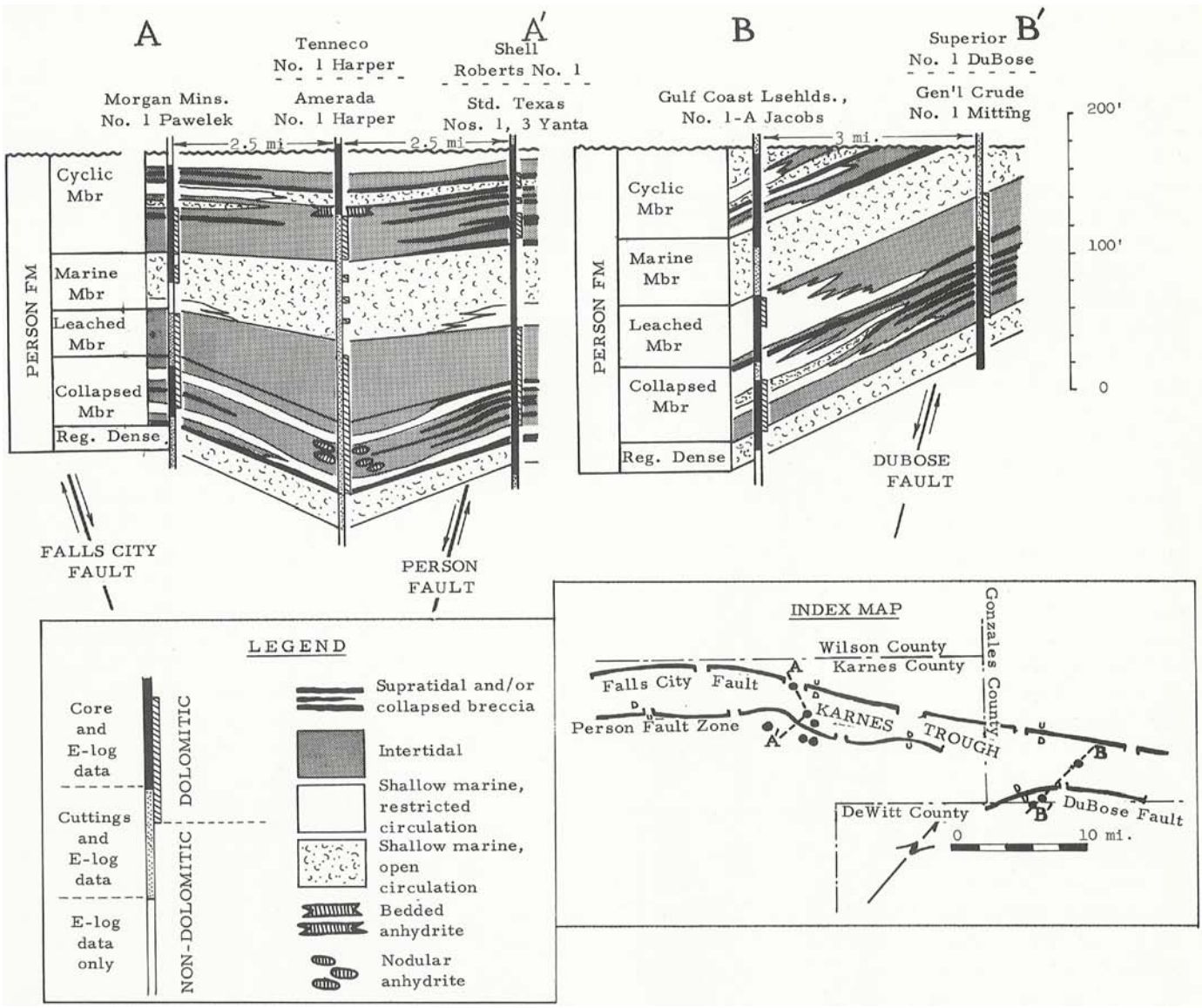


FIG. 11. Stratigraphic cross sections of the Person Formation from the Karnes trough on the upthrown block to the southeast showing lateral changes in beds; based mostly on core and sample data and supported by electric log correlations. Datum: top Person.

Edwards-Georgetown Boundary

The intact contact between the Edwards Group and Georgetown Formation has been examined in seven slabbed cores from the Person Field area. Evidence of unconformity is present in all.

The boundary is invariably abrupt and irregular (Pl. 9, A), with ½- to 1-inch vertical relief. Pyrite, organic matter, and chert are concentrated at the interface. In many cores the contact truncates shells or spar-filled fractures, leaving little doubt that the Edwards was indurated prior to deposition of the Georgetown. In three cores (Seaboard No. 1 Szalwinski, Karnes County, well index no. 38; Shell No. 2 L. Urbanczyk, Karnes County, well index no. 30; Mobil No. 1 Dornak, Atascosa County, well index no. 48) small caves filled with Edwards lithoclasts and Georgetown matrix occur in the Edwards as much as 3 feet below the contact (Pl. 9, C). A well-developed soil breccia is preserved immediately below the Georgetown in Standard of Texas No. 1 Wiatrek, Karnes County, well index no.

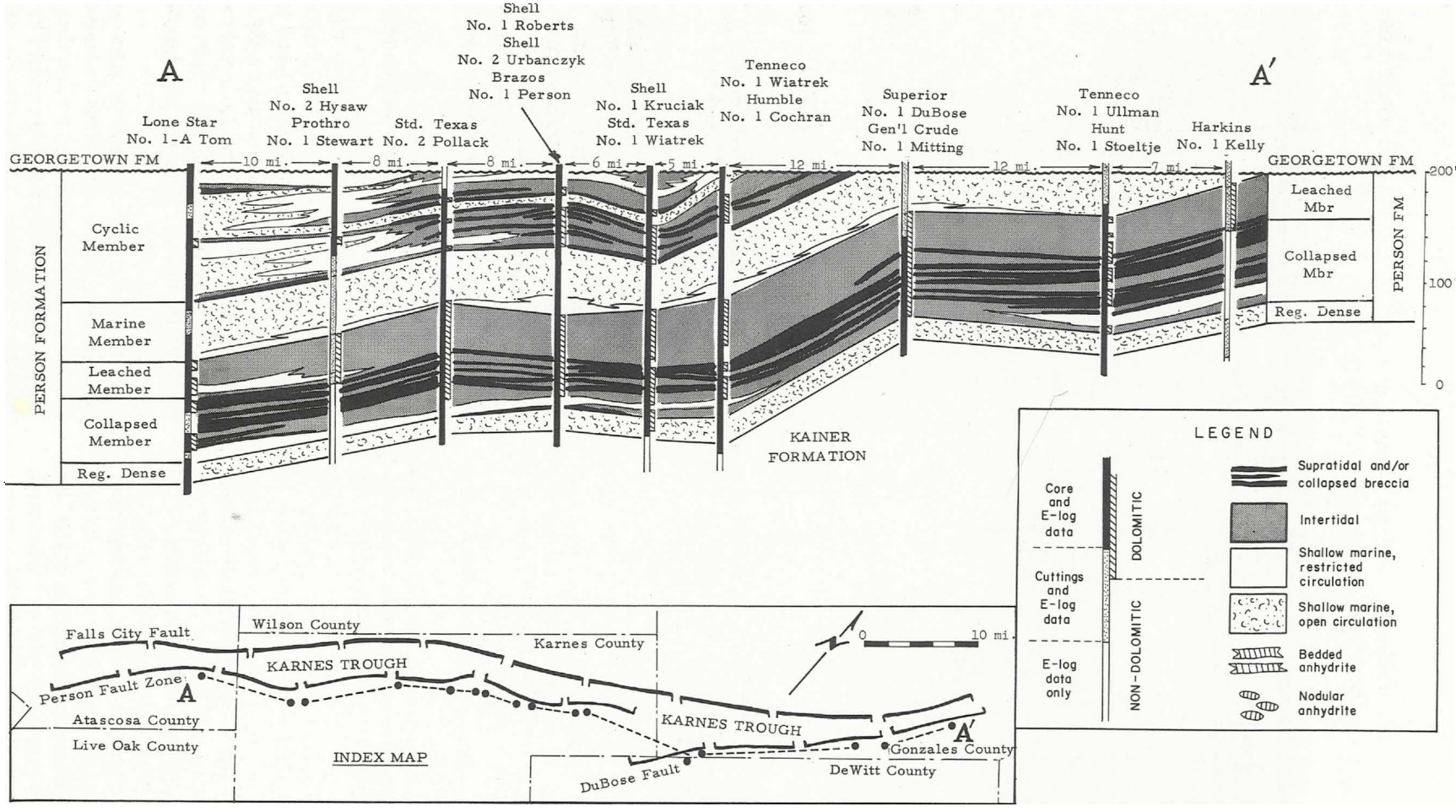


FIG. 12. Stratigraphic cross section of the Person Formation along the Fashing-Person trend showing lateral changes in beds; based mostly on core and sample data and supported by electric log correlations. Datum: top Person.

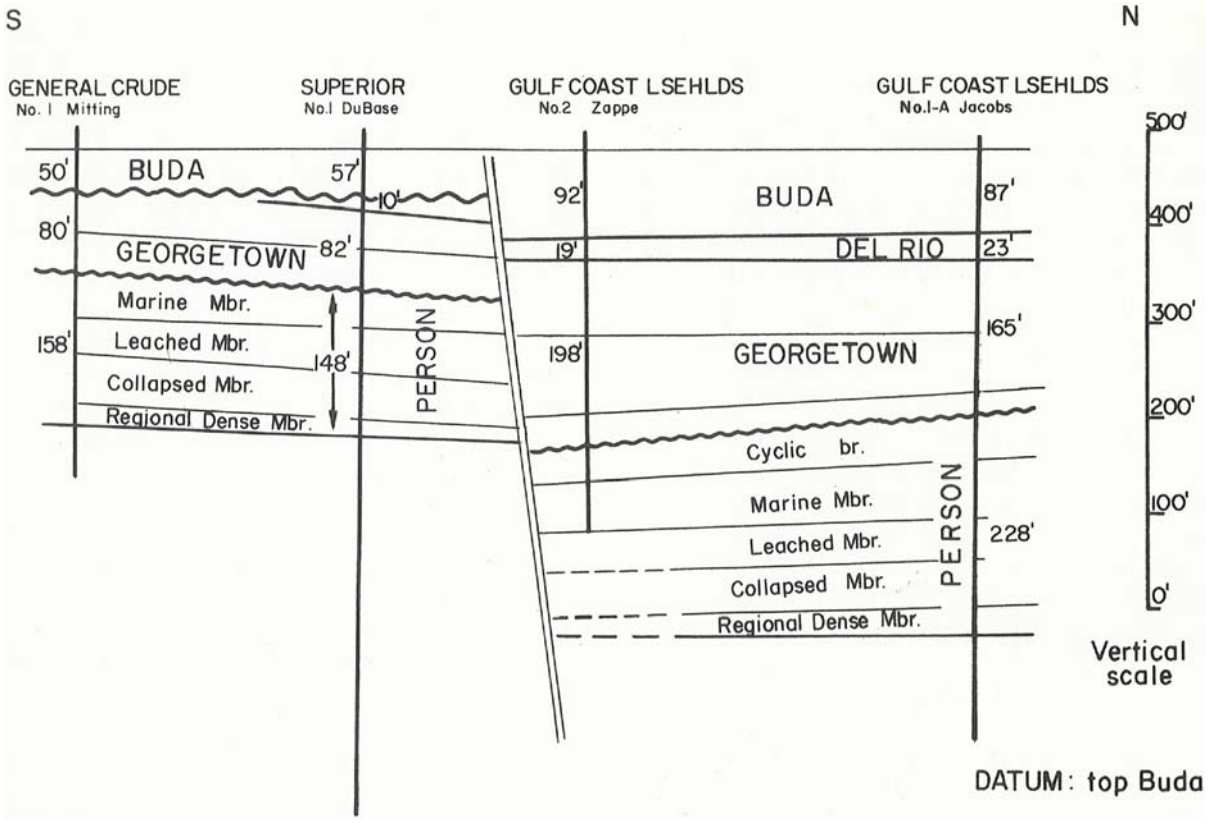


FIG. 13. Stratigraphic cross section showing unconformities and thickness changes in Washita stratigraphic units between the Karnes trough and the DuBose Field fault block (modified after Tucker, 1967b).

10 (Pl. 9, B). In all cores there is an abrupt change in fauna across the boundary. Figures 11, B, and 13 show that in the general area of DuBose Field the Marine and Cyclic Members are fully preserved beneath the Georgetown in the Karnes trough. On the upthrown block just 3 miles southeast, however, the Cyclic Member is not present and the Marine Member is 15 feet thinner.

Figure 12 is a stratigraphic cross section along the Fashing-Person trend on the upthrown block southeast of the Karnes trough, based mostly upon core data. The Person Formation appears as a southwestward-thickening wedge, and units in the Person Formation are successively truncated from southwest to northeast, from the flank toward the crest of the San Marcos Platform, further substantiating the unconformity. At Austin Pierce Field all of the Cyclic Member (70 feet thick at Person Field) and nearly all of the Marine Member (50 feet thick at Person Field) are missing below the Georgetown. This indicates that more than 100 feet of Person Formation was removed prior to deposition of the Georgetown, assuming uniform thickness of both members.

The Fashing—Austin Pierce electric log correlation section (Pl. 3, H) shows clearly the irregularity and discordance of Edwards units beneath the Georgetown-Edwards boundary, and dip sections across the Karnes trough (Pl. 3, C and D) show that the lowest layers in the Georgetown pinch out against the flanks of the upthrown blocks bordering the trough.

GEORGETOWN FORMATION

Dark brownish-gray, compact, argillaceous micrite containing fragile mollusc fragments, *Globigerina*, and microspherulites (calcispheres?) characterize the Georgetown Formation (fig. 10; Pl. 9, D).

Thickness of the formation ranges widely, between 260 feet in the Karnes trough to less than 80 feet on the upthrown blocks to the south (figs. 13 and 16).

In the only core containing the upper boundary of the Georgetown (Gulf Coast Leaseholds No. 1-A Jacobs, Gonzales County, well index no. 15), the Georgetown grades upward into the Del Rio through an interval of 2 feet.

DEL RIO CLAY

The Del Rio Clay consists of dark-gray calcareous shale containing *Globigerina* and fragile mollusc shells and is the only predominantly argillaceous formation in the Fredericksburg-Washita sequence. It is a blanket-like deposit, consistently 10 to 20 feet thick throughout the Fashing-Person trend except for the DuBose Field area in Gonzales County, where it is absent (fig. 17).

The upper boundary has been examined in only one core (Morgan Minerals No. 1 Pawelek, Karnes County, well index no. 23); here the Del Rio grades upward through 8 feet into the overlying Buda Limestone. At DuBose Field, however, electric log relations indicate a disconformity at this boundary, with all of the Del Rio removed beneath the Buda, the lower part of which is absent, probably by nondeposition (fig. 13). This has been described also by Tucker (1967b, fig. 3).

BUDA LIMESTONE

Lithically the Buda Limestone in the Fashing-Person area is essentially indistinguishable from the Georgetown except by stratigraphic position. It is consistently 80 to 120 feet thick except in the DuBose area, where it is less than 60 feet thick (fig. 18).

No cores spanning the upper boundary have been examined; electric logs indicate the contact to be a sharp lithic interface throughout the area, but no discordance can be detected between beds above and below.

Fredericksburg and Washita Rocks of the San Marcos Platform Area

In this part of the report relations and principles derived from detailed study of the Edwards in the Fashing-Person trend are applied throughout the area between the North Texas—Tyler basin and the Maverick basin. Widespread complete core data are not available, but three excellent complete cores (U. S. Corps of Engineers No. 1 Selma core hole, eastern Bexar County, well index no. 12; Southern Production Company No. 6 Jolley, northwestern Caldwell County, well index no. 5; and Mobil No. 40 Mercer, Luling Field, southwestern Caldwell County, well index no. 13) and sample data from about 25 wells were examined. Interlocking electric log correlation sections (Pl. 3, B-D, F-H) document the extension of boundaries throughout the San Marcos Platform area.

EDWARDS GROUP

Edwards—Glen Rose Boundary

It was explained (p. 18) that the base of the Fredericksburg (Edwards) is readily identified lithically and electrically in shallow wells in Travis County near the outcrop, where it is said (Moore, 1964, p. 6) to be a disconformity. Although the boundary is more difficult to ascertain elsewhere, it has been traced on electric logs throughout the San Marcos Platform area; in the Jolley and Selma cores the electric log boundary coincides with the base of a marly zone about 10 feet thick that contains oysters, probably *Exogyra texana* Roemer. This may be all that remains of the Walnut Formation on the San Marcos Platform. No evidence of disconformity can be seen at the boundary except that in the Selma core large clasts are present just above the contact. This is in harmony with observations of Moore (1964, p. 6) that the unconformity dies out southward onto the platform.

Kainer Formation

The Kainer Formation is readily identified from both sample and electric logs. Both the Dolomitic and Grainstone Members of the Fashing-Person trend can be recognized from cores and good samples. The Kainer is 280 to 320 feet thick at the outcrop (fig. 14). It thickens eastward into the North Texas—Tyler basin, where it is about 580 feet thick in Fayette County; southeastward onto the San Marcos Platform, where it is uniformly 340 to 400 feet thick; and westward into the Atascosa trough, where it is about 420 feet thick. Judging from isopach "thins," the axis of the San Marcos Platform during deposition of the Kainer passed southward through Guadalupe, southwestern Gonzales, and northeastern Wilson counties.

Data on subsurface dolomite distribution are not abundant, but they suggest (fig. 14) the presence of a very high concentration of dolomite, roughly coincident with the axis of the San Marcos Platform, extending from the Fashing-Person trend to the outcrop. This trend was not shown by Fisher and Rodda (1967, fig. 5; 1969, fig. 7). In addition to the previously mentioned massive fine-crystalline dolomite (Pl. 5, A), the Dolomitic Member in the shallow Jolley and Mercer cores also contains abundant stromatolitic crusts (Pls. 5, B; 8, B), disrupted zones, exposure surfaces, and spectacular collapse breccias (Pl. 17, B). However, in a wide belt to the southwest (for example, in the Selma core) distinct-

ly fewer such tidal flat features are present, and the equivalent interval contains instead predominantly mollusc-fragment and miliolid biomicrite of shallow marine aspect. A similar but narrower shallow-marine belt probably exists on the northeast flank of the platform, through Travis, Bastrop, and Fayette counties. In the upper part of the Dolomitic Member, the Selma core is cavernous and highly altered, with abundant red clay-filled cavities reported by drillers.

The boundary between the Dolomitic Member and overlying Grainstone Member in the Selma, Mercer, and Jolley cores is conformable but abrupt. In the Selma core miliolid biosparite grades downward into compact, porcellaneous micrite with incipient breccia cracks, that overlies a 2-foot zone of *Toucasia* biomicrite. Beneath the *Toucasia* bed occurs cavernous recrystallized limestone, dolomite, and collapse breccia filled with red clay. The boundary is placed at the base of the *Toucasia* bed.

In the Jolley core the boundary is a sharp interface between thinly interbedded miliolid biosparite and biomicrite above, and a dolomitized supratidal sequence below, complete with collapse breccia (Pl. 17, B). In the Mercer core wispy pelleted miliolid biomicrite with scattered clasts rests upon a partly collapsed dolomite sequence; the interface is sharp and even.

Person Formation

Person-Kainer boundary.—This boundary is placed essentially as it was in the deeper subsurface areas: at the abrupt change upward from miliolid biosparite to argillaceous, wispy biomicrite. In the Jolley core red-stained burrows are present just above the contact, and in the Mercer core large coated clasts occur in a 2-foot "boundary-zone." In the Selma core the contact is gradational through an interval of about 1 inch.

The Kainer-Person boundary has features that suggest a low-rank disconformity or zone of by-passing in the Fashing-Person trend. It was pointed out (p. 14) that this boundary can be traced from the San Marcos Platform into Northeast Texas where it is the base of the Kiamichi Formation and the boundary between the Fredericksburg and Washita Divisions. According to Shelburne (1959, p. 116) the base of the Kiamichi is a disconformity; according to Lozo (1959, p. 18) it is conformable but abrupt. Inasmuch as truncation of underlying beds or irregularity of the contact itself cannot be demonstrated, even regionally, it seems appropriate to recognize it only as a regionally significant but conformable boundary.

Regional Dense Member.—This thin marker zone is readily identified on electric logs and in cores as a marly, wispy biomicrite interval 15 to 22 feet thick (Pl. 6, D). It contains abundant oysters in the Jolley, Selma, and Mercer cores, and a thin *Toucasia* and oyster bed in the Mercer core. The Regional Dense Member can be traced over the entire San Marcos Platform area except for the western part, where it disappears into a mass of undivided shallow marine carbonates in Medina and northern Frio counties (Pl. 3, F). This mass appears to be the extension of the Devils River Formation of Lozo and Smith (1964) into the subsurface and is discussed more fully on page 26. In a similar way, the Regional Dense Member presumably disappears into the Stuart City Reef to the southeast.

Person Formation undivided.—In the Fashing-Person trend, as discussed earlier (p. 23 and fig. 12) the Person Formation is a wedge thickening to the southwest, away from the axis of the San Marcos Platform. This same wedge form is apparent in the shallow subsurface part of the platform as well: The Person thickens from about 100 feet near the Caldwell-Bastrop County line to 260 feet in southern Bexar County (fig. 15). Isopachous mapping suggests the presence of a gentle northeast-southwest ridge on which the Person is 20 to 40 feet thinner than to either side. This ridge lies on the downthrown side of the antithetic Luling fault zone. Its origin and relation to the fault, if any, are unknown.

The Collapsed, Leached, Marine, and Cyclic Members of the Fashing-Person area cannot be recognized in the shallower San Marcos Platform area, in part because of increased and more pervasive massive dolomitization that tends to obliterate sedimentary structures. The Jolley and Mercer cores contain particularly striking evidence of shallow, hypersaline conditions, with common stromatolitic crusts, pseudomorphs after gypsum, exposure surfaces, and collapse breccias. To the northeast, however, along the northeast flank of the San Marcos Platform, lies a narrow belt of less dolomitic, more bioclastic rocks and to the southeast, in Bexar, western Wilson, and Atascosa counties, is a wider analogous tract, as represented by the Person Formation in the Selma core.

Edwards-Georgetown Boundary

This boundary was demonstrated to be a disconformity in the Fashing-Person area. In the Selma

and Jolley cores the contact is simply abrupt, but in three other shallow Caldwell County cores (Shell No. 1 Clayton C-H, well index no. 2; Mobil No. 40 Mercer, well index No. 13; Shell No. 1 Thompson C-H, well index no. 26) evidence for disconformity is more convincing: The boundary is pitted and bored, with Edwards clasts resting on the abrupt contact, which is marked by concentrations of pyrite and black pisoliths. In the Thompson core Georgetown biomicrite fills a cave 8 inches below the contact.

The conclusion to be drawn is that the top of the Edwards is a disconformity throughout the San Marcos Platform area. Most of the San Marcos Platform was probably exposed, but the actively eroded area probably was smaller, roughly coincident with the broad area of dolomitic tidal flat deposits on the axis of the platform.

DEVILS RIVER FORMATION

The Regional Dense Member disappears along an irregular line through Medina and Frio counties (fig. 15). North and west of its disappearance the Person and Kainer Formations are no longer separable and are combined as the Devils River Formation (Pl. 3, F and G), just as Lozo and Smith (1964, pp. 291, 297) defined their Devils River Formation by the absence of the marker bed that allowed subdivision. Furthermore, the area of subsurface Devils River appears to be the southeastward projection of the Devils River belt of Lozo and Smith (1964, fig. 6). The subsurface Devils River seems to widen in the shallow subsurface and "splay out" in a series of lobes (Pl. 2). The southern two lobes seem to die out along the axis of the Pearsall Arch, suggesting not only that the arch was active during Devils River deposition, but that deeper water to the southeast of the arch in the Atascosa trough limited the southward development of shallow-water bank-type carbonate sediments. The area where Devils River grades into platform interior sediments would appear to have been a highly sheltered and restricted area in the lee of the Stuart City Reef, a location not favorable for flourishing development of shelf-margin organic banks.

On the open shelf area north of the Stuart City Reef, east of the Maverick basin and south of the Pearsall Arch, the Regional Dense Member is still recognizable (Pl. 3, E), and accordingly the Kainer and Person Formations are still identifiable. In this area both are composed of biomicrite and biosparite with common mollusc fragments and miliolids. Dolomite is sparse.

GEORGETOWN FORMATION

There is a gradual change in the dark, argillaceous, fine-grained Georgetown from the Fashing-Person trend up dip to the Bexar-Guadalupe-Caldwell County area. In shallow cores such as the Mercer, Selma, and Jolley, the Georgetown is light gray, with more abundant whole mollusc shells and shell fragments and a fauna characteristic of the outcrop Georgetown, including *Gryphaea washitaensis* Hill and *Kingena wacoensis* Roemer. Still present in abundance are microspherulites (probably calcispheres) and *Globigerina*, and the formation still has thin argillaceous intervals.

The San Marcos Platform is well defined by the 60-foot Georgetown isopachous contour (fig. 16), and the Georgetown thickens from the platform eastward into the North Texas—Tyler basin, southeastward into the Karnes trough, and southward into the Atascosa trough. To the northwest the formation becomes irregularly thinner, from 60 to 20 feet. Shallow cores spanning the upper boundary are not available, but judging from electric logs the Georgetown—Del Rio boundary is conformable and abrupt, or gradational through a very thin interval.

Electric log correlation within the Georgetown on the San Marcos Platform indicates that it consists of a thin series of beds that can be individually traced over most of the platform area (Pl. 3, B-D, F, and G) as well as out into both the Maverick and North Texas—Tyler basins. Lowest beds appear to pinch out against the Edwards in the shallowest parts of the subsurface San Marcos Platform.

Isopachous mapping (fig. 16) of the Georgetown provides clear evidence of tectonic elements that were mobile during Washita time. The Maverick and North Texas—Tyler basins show up as broad areas of thick Georgetown, with a broad, rounded "nose" of thin Georgetown in between—the San Marcos Platform. The Karnes and Atascosa troughs appear as long sinuous "thicks" or channels into which the Georgetown thickens markedly and abruptly. These troughs serve to isolate a triangular, plateau-like area of thin Georgetown in southwestern Atascosa County. The Pearsall Arch shows up as a "nose" plunging southwest across Frio County.

DEL RIO CLAY

Aside from its lateral continuity, the Del Rio is most remarkable because, from the outcrop belt, it becomes *thinner* down the dip, whereas all other Fredericksburg-Washita units on the San Marcos Platform become *thicker* in that direction (fig. 17).

The Del Rio is about 50 feet thick on the axis of the San Marcos Platform near the outcrop, thickens to northeast and southwest, but thins evenly toward the Stuart City Reef. On the seaward side of the Stuart City Reef the Del Rio thickens again to more than 100 feet thick (Winter, 1962, pp. 109, 110); the probable explanation is that the Comanche shelf margin was rising gently during deposition of the formation.

The Del Rio consists of dark bluish-gray, calcareous, pyritic, bentonitic clay and shale with scattered mollusc fragments and *Globigerina*. This lithology is characteristic in the North Texas—Tyler and Maverick basins also. On electric logs the Del Rio manifests itself as an interval of deeply and unevenly suppressed S.P. and resistivity curves. The Del Rio is transitional upward into the Buda Limestone, with a 15- to 20-foot zone of intercalation in Fayette, southern Bastrop, and northern Gonzales counties.

BUDA LIMESTONE

In the Fashing-Person area the Buda is lithically indistinguishable from the Georgetown, but passing northwestward onto the shallower parts of the San Marcos Platform the formation becomes light gray and porcellaneous, retaining, however, the common *Globigerina*, fragile mollusc fragments, and microspherulites. Near the Balcones fault zone the Buda contains common red-stained intraclasts that Hixon (1959) interpreted as derived from the upthrown side, indicating incipient Balcones activity during deposition of the Buda. Isopachous mapping (fig. 18) indicates, however, that the Balcones-Luling system was static during Buda deposition (p. 3). The formation maintains a similar lithology in both basins as well as on the San Marcos Platform and is uniformly 60 to 80 feet thick over most of the platform. It thickens to more than 160 feet in the Maverick basin.

Judging from electric logs (Pl. 3), its upper boundary is abrupt; at the outcrop this surface is, of course, the boundary between the Comanche and Gulf Series and has been treated traditionally and with little challenge as a regional disconformity. Even so, no truncation or irregularity can be seen locally or regionally at the boundary throughout the subsurface area of study. The boundary is very distinct on electric logs and has been used as a horizontal reference line in constructing the stratigraphic sections (Pls. 3, 4).

EDWARDS-GEORGETOWN RELATION—FACIES OR TOPOGRAPHY?

The interpretation by Tucker (1962a, 1962b) of a facies relation between lower Georgetown and the Person Member (his Upper Edwards) has been previously discussed (p. 14). Several salient points should now be emphasized:

(1) The Georgetown sequence of North Texas is generally considered to represent continuous marine deposition.
(2) Correlation sections (Pl. 3, F and G) show clearly that the thin electric log units labeled "Weno-Pawpaw" and "Main Street" in the upper Georgetown can be traced continuously from the North Texas—Tyler basin onto and across the San Marcos Platform into the Maverick basin. On the shallower parts of the subsurface San Marcos Platform, the lowest unit, Denton, thins and appears to pinch out against the Edwards.
(3) The Person Formation of the San Marcos Platform, therefore, occupies the same *geometric* position as the Kiamichi, Duck Creek, and Fort Worth Members of the basin.
(4) Beyond the southwest end of Tucker's cross section the Person continues as a wedge that thickens to the southwest (fig. 19, B).
(5) The top of the Edwards is a disconformity over most of the San Marcos Platform, and more than 100 feet of upper Person was apparently stripped away over the axis, less than 10 miles southwest of the end of Tucker's cross section.
(6) Tucker did not have access to item 5 at the time he made his interpretation.

In the vicinity of the southwest end of Tucker's diagram (fig. 19, A), it is certain that the top of the Edwards is a disconformity, with some tens of feet of upper Person missing by erosion. It seems probable that while the top of the Edwards was being eroded on the crest of the San Marcos Platform, some beds must have been deposited in the North Texas—Tyler basin, where the continuous marine Georgetown sequence was accumulating. If this assumption is correct, such beds must lie in the Duck Creek-Fort Worth-Denton sequence, for all strata *above* Denton are continuous onto and over the eroded Person crest, and the Kiamichi *below* can be traced into the Regional Dense Bed at the base of the Person. Furthermore, these beds must pinch out against Person topography on the northeast flank of the San Marcos Platform.

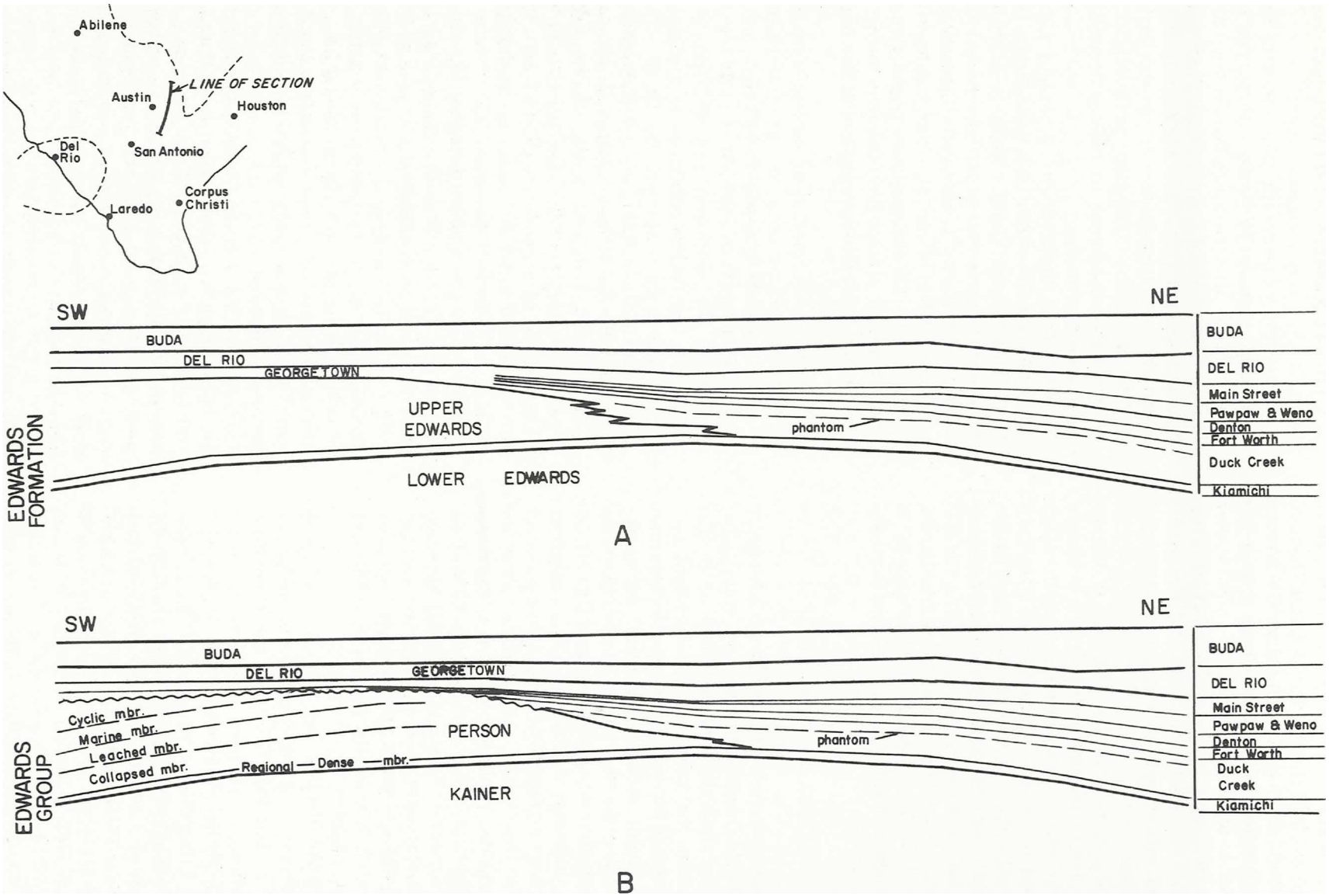


FIG. 19. Relations of Edwards and Georgetown. A, According to Tucker (1962a, 1962b). B, Interpretation preferred by Rose.

The thickness of the Duck Creek-Fort Worth-Denton sequence that pinches out against the platform is not known; if the sequence was accumulating continuously during the time required to erode more than 100 feet of Person Formation, one suspects it should be thick enough to be identified at the scale of this investigation. Electric log correlation and lithologic similarity suggest that the Person grades into only the lower part of the Duck Creek, and therefore that the upper part of the Duck Creek and the Fort Worth pinch out onto a low-angle Person clinoform (Rich, 1951) between the San Marcos Platform and the North Texas—Tyler basin. The Denton passes onto the platform but apparently pinches out against the axial culmination.

Accordingly, the preferred interpretation (fig. 19, B) is that the Person Formation on the crest of the San Marcos Platform is equivalent to the Kiamichi and only about the lower half of the Duck Creek; that the upper Duck Creek, Fort Worth, and Denton pinch out against Person topography; and that most of the *apparent* equivalency is the result of depositional topography, not facies relations. The only facies relation is that between the platform rock of the Person as it thins basinward and grades into open marine rock of the lower Duck Creek. This appears to be a good example of a stratigraphic unit *thickening* toward the platform, probably because of greater carbonate production in the shallower waters, or because the tidal flats and very shallow marine areas of the entire San Marcos Platform area acted as a "sediment trap," a concept first explained to the writer by R. N. Ginsburg. His idea was that in very shallow protected areas carbonate sediments can readily be transported in and stranded (by storms, for example), but it is almost impossible for natural processes to remove sediments once they have been deposited there. The result is preferential accumulation of fine carbonate sediments in shallow, protected areas. This process is operating now in areas of modern carbonate sedimentation such as Florida Bay and the western coasts of Andros and Abaco Islands, B.W.I.

If the topography interpretation is correct, then a low-angle clinoform existed along the northeast flank of the San Marcos Platform during deposition of the Person Formation. Vertical relief between crest and foot, measured over about 10 miles, was between 50 and 100 feet, based upon thickness differences of the rock units. Depositional slopes this gentle may not fit the generally accepted concept of the clinoform, but Rich (1951, p. 7) himself placed no lower limit on the dip of the clinoform.

Lithologic and geometric relations of the Edwards and Georgetown on the northeast flank of the San Marcos Platform are duplicated on the southwest flank of the platform by the upper Devils River—Salmon Peak—Georgetown sequence (Pl. 3, E-G). There the Pryor Member of the Salmon Peak is the thin basin equivalent of the upper Devils River—Person platform sequence, and the upper Salmon Peak laps onto the Pryor clinoform before covering the platform. Judging from correlation sections, the vertical relief along the eastern side of the Maverick basin was about 200 feet near the end of Person-Pryor deposition, and the clinoform was thus much steeper there than on the opposite side of the San Marcos Platform. There is no evidence to support Winter's interpretation of a facies relation between "Pryor" and "upper Georgetown" (= upper Salmon Peak) in the deeper parts of the Maverick basin.

EDWARDS GROUP, EASTERN EDWARDS PLATEAU, CENTRAL TEXAS

Introduction

The eastern Edwards Plateau is a generally flat-lying, elevated tableland composed of resistant limestone and dolomite rocks of the Edwards Group. The Plateau is limited on the north by the Llano Uplift and on the south and east by the Balcones fault zone (Pl. 2). It is deeply and thoroughly dissected by small rivers and their tributaries that cut headward into the Plateau from north, east, and south: The Llano, Pedernales, Guadalupe, Medina, Sabinal, Frio, and Nueces Rivers flow radially away from a broad divide in eastern Edwards, northern Real, and western Kerr counties. Soil cover and deep caliche limit good outcrops in the upland areas, but canyons and highway road cuts provide abundant excellent exposures elsewhere.

In most of the area the Edwards Group rests on the impervious, argillaceous Glen Rose Formation. The lower 50 to 75 feet of the Edwards is quite porous. This combination produces a widespread aquifer in the lower Edwards from which most upland ranches derive water by windmill-powered wells. Strong permanent springs issue from the base of the Edwards in steep-walled canyons at the heads of the major tributaries, forming lush oases with ferns and tall stands of pecan, Spanish oak, syca-

more, and cypress trees that contrast sharply with the surrounding semi-arid juniper-covered rocky slopes and open-divide grasslands. Sinkholes, collapsed areas, and caverns are common throughout the region.

Stratigraphy

Edwards Group

Base of the Edwards

In most of the map area the Edwards rests upon the Glen Rose Formation. In northern Gillespie County and in other areas adjacent to the Llano Uplift, however, the Glen Rose grades into red and brown calcareous sandstone and clayey siltstone called "Hensel Formation." In these areas the Edwards rests upon Hensel. Figure 20 is a subcrop map showing the areal Glen Rose—Hensel relation immediately beneath the Edwards. Near Segovia, Junction, and Roosevelt in the northwestern part of the area the Edwards overlies unfossiliferous, light-gray and red, calcareous siltstone that is lithically intermediate between Glen Rose and Hensel and to which no formal name has been applied. The distribution of this intermediate lithosome is also indicated on figure 20. This unit is between 200 and 300 feet thick in the valleys of Llano River and Johnson Creek. It is particularly well exposed on the east bank of South Llano River at Junction.

In a few scattered localities, mostly in northern Gillespie County, knobs of Precambrian and Paleozoic rock project up into the Edwards. About 1 mile south of locality 6 the Edwards rests on Cambrian Cap Mountain Limestone, and at Bear Mountain, about 4 miles due north of Fredericksburg, the Edwards rests on Precambrian granite.

The base of the Edwards is probably a disconformity. Although evidence for erosion is wanting at some exposures of the boundary, the area-wide aggregate of features presents a fairly convincing case. The boundary is ordinarily abrupt or a very thin "rotten" zone and nearly always represents a distinct lithic change, the rock above being distinctly more marine. At many localities, particularly in the southern and eastern parts of the area, the top of the Glen Rose is red stained, lumpy, irregular, and bored, with oysters cemented onto the surface, indicating that the Glen Rose was lithified prior to Edwards deposition. At locality 64 near Mountain Home, cracks in the uppermost Glen Rose are filled with oyster marl of the basal Edwards, again indicating pre-Edwards lithification (Pl. 10, A). Thin, oxidized terrigenous sandstone beds are present in the basal Edwards at the Junction, Segovia, Stieler Ranch, and West Sister Creek sections, and the entire basal member of the Edwards appears to have changed to siltstone and sandstone at the Fort Terrett section. The lower part of the basal member is very sandy at the Cherry Spring section. At locality 8, about 10 miles due north of Fredericksburg, fossiliferous sandstone boulders are present in the basal 2 feet of the Edwards.

There are outcrops, such as the Kerrville section, however, where the boundary is transitional; furthermore, observable discordance between the Edwards and Glen Rose or Hensel, either locally or regionally, cannot, to the writer's knowledge, be demonstrated.

For mapping purposes the base of the Edwards is drawn at the change upward from recessive argillaceous rock to resistant massive limestone (Pl. 10, C). In most places a nodular marly zone from 6 inches to 10 feet thick, rich in *Exogyra texana*, lunatid and turritellid snails, and protocardid clams, constitutes the basal Edwards. Because the massive limestone immediately above is a porous aquifer, a dense band of vegetation, particularly Spanish oak, is present at and just above the base of the Edwards, forming a splendid tree-line for air-photo mapping.

Fort Terrett Formation (New)

It was previously pointed out (p. 17) that Lozo and Smith (1964) recognized but did not formally name two stratigraphic units within the Edwards north of the Devils River trend, the basis for subdivision being an unconformity at the base of the thin marly horizon called "Dr. Burt." Smith chose Fort Terrett as an informal name for the lower unit and has suggested (personal communication, May 1968) that the term be adopted formally in the present report, since it has already found common informal usage. Accordingly, the term Fort Terrett is here formally proposed for the lower unit. The Fort Terrett measured section (Appendix C) includes Smith's type locality of the Fort Terrett Formation as well as the upper unit of the Edwards; the lithic description is this writer's, but the graphic profile of the Fort Terrett was drawn by Smith, who allowed its use in this report. Smith (1970, p. 36) stated that the unnamed lower unit of Lozo and Smith (1964) is the Del Carmen Formation of the Big Bend region, West Texas (Maxwell et al., 1967, p. 36), and used Del Carmen in the western

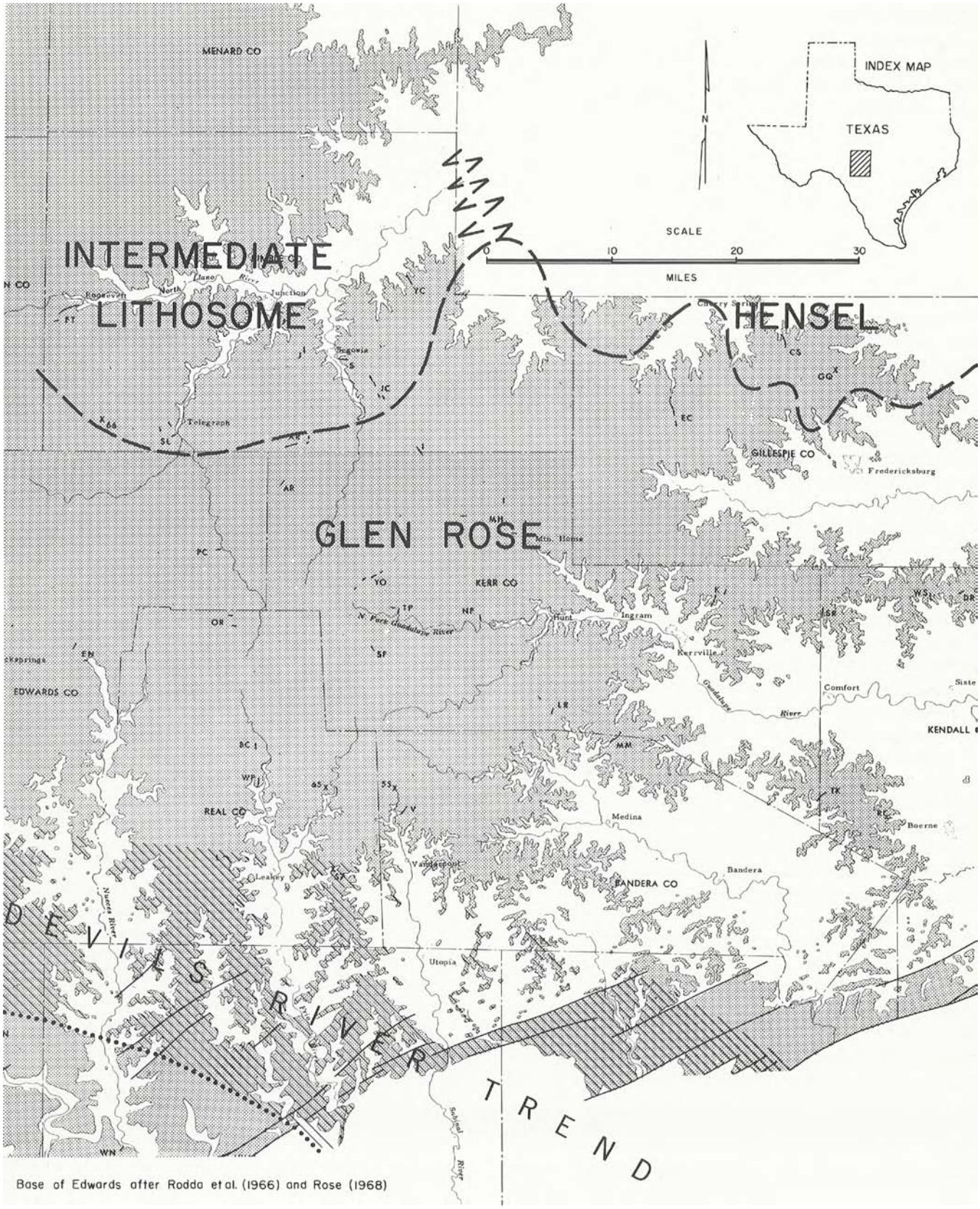


FIG. 20. Subcrop map showing rock units underlying the Edwards Group.

Edwards Plateau. Fort Terrett is preferred in the eastern part of the Plateau because: (1) There is a gap of several hundred miles between the Big Bend area and the eastern Edwards Plateau in which the lower unit has not been mapped; (2) although physical continuity between the two is probable, greatly increased restriction, elevated salinities, and higher evaporation rates are indicated by common dolomite and evaporite in the Fort Terrett, neither of which is mentioned in Maxwell et al.'s descriptions of the Del Carmen.

The type locality is in road cuts of U. S. Highway 290 where the highway rises out of the valley of North Llano River onto the Edwards Plateau about 0.5 mile south of Roosevelt, Kimble County, Texas. The name comes from old Fort Terrett (abandoned), about 8 miles west, one of a series of frontier army posts built and occupied in the 1850s.

The Fort Terrett Formation is only 160 feet thick at the type locality. This is the thinnest known interval of the formation in the map area and may indicate that the Roosevelt high was mobile during Fredericksburg time. Isopachous mapping (fig. 21) shows that the formation thickens evenly from about 180 feet along the northern edge of the map area to more than 300 feet on the northern margin of the Devils River belt. A small "thin" on the Kerr-Bandera County line coincides with the Medina axis and may be an indication of its mobility during Fredericksburg time. Comparison of regional Fort Terrett dolomite distribution (fig. 21) with structure maps (figs. 4 and 5) shows a striking correlation between highly dolomitized areas and structurally positive areas. Because much dolomitization is thought to be related to deposition or very early diagenesis in extremely shallow water or supratidal environments, this is another indication of Early Cretaceous movement of the Medina axis and other positive features near the Devils River belt.

Lithofacies mapping of this interval by Fisher and Rodda (1967, 1969) on the south flank of the Central Texas Platform does not agree with findings of this report. They showed (1967, fig. 5; 1969, fig. 7) too little dolomite (less than 10 percent vs. more than 30 percent) in Kerr, northern Real, and Bandera counties. Also they indicated (1967; 1969, fig. 12) a broad area southwest of Junction where the grainstone/mudstone ratio ranges from 0.8 to 5. The South Llano, North Fork Composite, West Frio, Vanderpool, and Medina Mountain measured sections (Appendix C) show clearly that mud-supported rocks in that area are two to four times more abundant than grain-supported rocks in the Fort Terrett Formation. Finally, they indicated (1969, fig. 13) that chert becomes regularly less abundant southwest of the Central Texas Platform. This pattern seems more apparent than real: Some measured sections near the platform, such as Cherry Spring, have proportionately much fewer chert horizons than do some measured sections far to the southwest, such as West Frio and Vanderpool.

The term Fort Terrett Formation is applicable to the lower unit of the Edwards throughout the area of the geologic map north of the Devils River belt. The formation is divided as follows: Basal Nodular Member, Burrowed Member, Dolomitic Member, and Kirschberg Evaporite (Barnes, 1944). The Fort Terrett is described in 16 measured sections in Appendix C, and a generalized rock description is shown in figure 22. Except for special emphasis, the rock succession will not be repeated here.

Basal Nodular Member (informal).—The lowest unit of the Fort Terrett Formation is present throughout the area and can be recognized even in the base of the Devils River mass. It contains terrigenous sand in outcrops near the Llano Uplift and on the Roosevelt high, but the detrital admixture becomes insignificant toward the top of the member. Over most of the area the member consists of soft, recessive, silty oyster marl grading upward to nodular biomicrite with scattered clams and snails. It generally weathers to a covered, heavily vegetated, rubbly slope. Its upper boundary is gradational. The Basal Nodular Member is ordinarily 25 to 40 feet thick, becoming thicker southward.

The units "Walnut" and "Comanche Peak" of Barnes's mapping in Gillespie, Blanco, and Kendall counties (1952-1967) constitute approximately the Basal Nodular Member. His terminology has not been adopted for two reasons:

(1) His units are not profitably mappable at the scale of the geologic map, 1:250,000 (Pl. 1).
(2) Recommendations of Lozo and Smith (1964, p. 290) and Moore (1967, p. 69) are followed in restricting usage of Walnut and Comanche Peak to the area north and east of the Llano Uplift.

Burrowed Member (informal).—Massive, resistant layers of porous, burrowed limestone are common in the lower half of the Fort Terrett and are the basis for recognition of the Burrowed Member. The lower boundary of the unit is placed at the lowest occurrence of thick sequences of nonargillaceous burrowed micrite and biomicrite. Irregular nodules of bluish-gray and brown chert and thin dolomite beds are also common constituents. Except for the Medina axis salient, dolomitic content of the

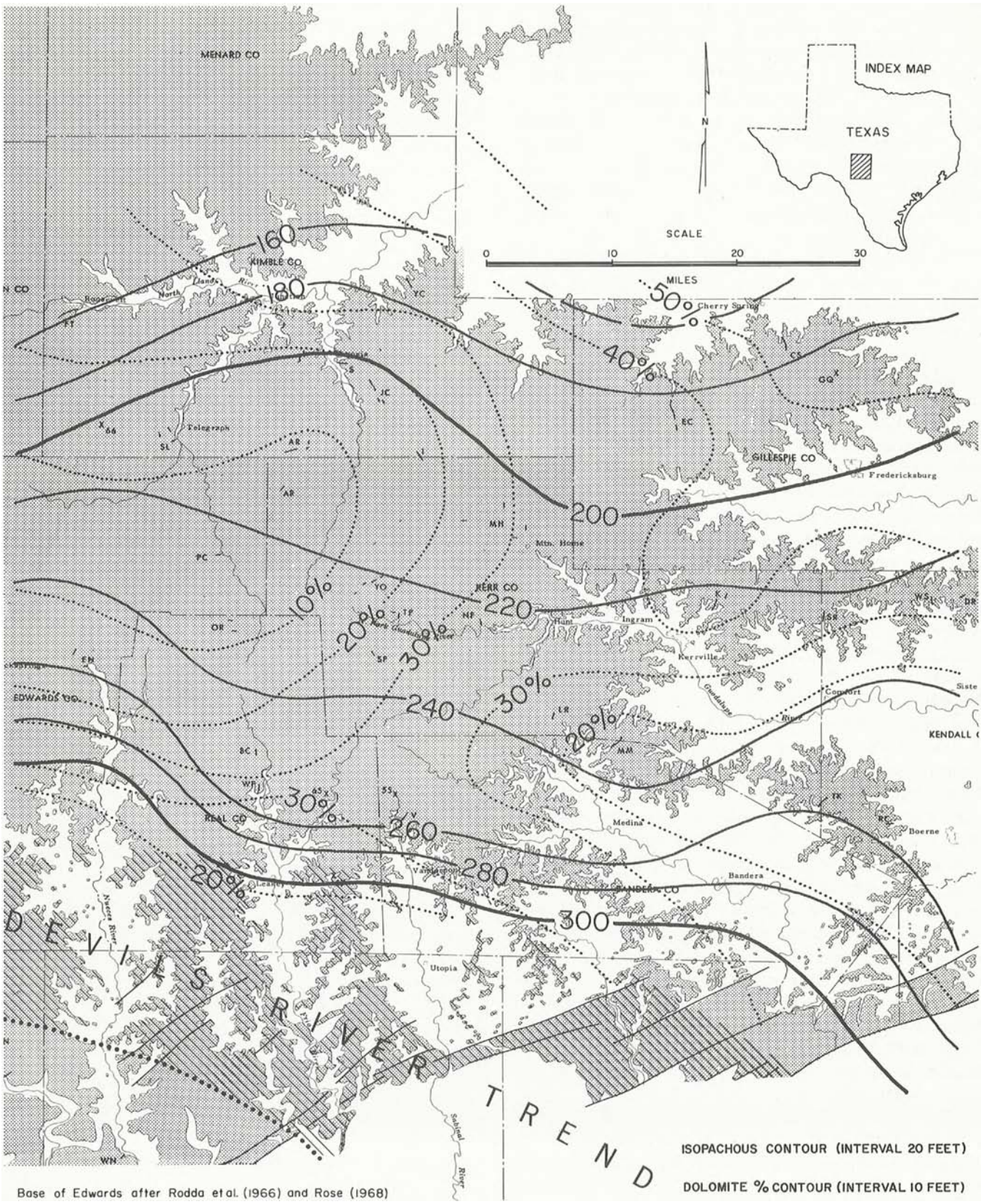


FIG. 21. Isopachous and dolomite-percentage map, Fort Terrett Formation.

Burrowed Member decreases away from the Llano Uplift. Toward the top of the unit thin beds of miliolid and mollusc-fragment biosparite, some rippled and cross-bedded, alternate with the thin dolomite beds. There are a few beds of marl, many of which have been altered to pulverulent limestone.

Over most of the area the Burrowed Member is 70 to 90 feet thick but near the Llano Uplift it thins (to 55 feet in the Edwards Creek section and to 35 feet in the Cherry Spring section). Its upper boundary is gradational.

The Burrowed Member is the chief water-bearing zone of the Edwards. The porosity is the result in part of preferential leaching and removal of burrow-fillings, producing superb honeycomb porosity (Pl. 10, B).

Dolomitic Member (informal).—In the upper part of the Fort Terrett Formation massive- to thin-bedded, fine- to medium-crystalline, homogeneous dolomite becomes the dominant rock type. The base of the Dolomitic Member is placed at the lowest occurrence of thick sequences of dolomite overlying predominantly burrowed rocks. Beds of fine-crystalline limestone alternate with the dolomite near the top of the unit; at the Vanderpool section the two are intertongued (Pl. 19, B). There are a few beds of miliolid and rudistid biosparite, and chert is abundant throughout. In the Stieler Ranch, Kerrville, and North Fork sections a caprinid biostrome is present at the base of the unit. Some dolomite has been altered to pulverulite.

Most of the dolomite is the homogeneous burrowed variety, but stromatolitic hard crusts, root marks, mud cracks, and bird's-eye structure indicating tidal flat deposits are found in northern measured sections. Ripple marks, current streaks, fine planar cross-beds, and flat mud clasts are scattered through the member. Evidence of restriction and high salinity is provided by indications that the dolomitic sediments once contained gypsum nodules. In many outcrops spheroidal vugs are arranged in long rows parallel to bedding. Some of these vugs contain miniature collapse breccias, always at the bottoms of the cavities (Pl. 10, D). These are almost certainly the remains of gypsum nodules that have been dissolved.

The Dolomitic Member ranges from about 40 to 90 feet thick; it is thinnest near the Llano Uplift and thickens southward.

Kirschberg Evaporite Member (emended).—Barnes (1944) proposed the term Kirschberg Evaporite for a gypsum horizon in the Edwards in Gillespie County and clearly intended that the term should apply not only to the small amount of gypsum remaining near Fredericksburg and Menard but also to the widespread disturbed and altered zone that marks its former presence as well. Subsequent workers (Lozo and Smith, 1964, fig. 8; Moore, 1967, p. 68) have therefore used "Kirschberg breccia" and stated that it correlates with the gypsum of Gillespie County.

Comparison of the Gypsum Quarry and Cherry Spring measured sections (Pl. 4) indicates that the bulk of the gypsum interval correlates not with breccia but with a thick zone of coarse-crystalline limestone and travertine that has only a thin breccia at the top. A similar zone of altered, recrystallized limestone, dolomite, and travertine is prevalent throughout the map area and commonly contains two zones of breccia. Accordingly, the term Kirschberg is emended so that it includes the entire altered interval, and in addition, the few remaining feet of dolomite and limestone between the gypsum horizon and the top of the Fort Terrett. This uppermost Fort Terrett interval contains thin-bedded lithographic to porcellaneous micrite, hard miliolid biosparite, and gray fine-crystalline dolomite. It is present both as a collapse breccia (Pl. 11, A) and as more or less undisturbed beds and is a distinctive and reliable field mapping marker. Commonly, the porcellaneous micrite is intricately fractured but not severely disrupted—this pattern is referred to as incipient brecciation (Pl. 11, B).

At the Gypsum Quarry section the gypsum is 27.5 feet thick, but Barnes (1944, p. 40) reported up to 35 feet in the vicinity. The gypsum is massive, light to dark gray, and distinctively nodular or "augen-structured" rather than laminated. It contains irregular nodules of grayish-brown chert, reddish-brown travertine, and thin discontinuous lenses of soft brown homogeneous dolomite (Pl. 12, A).

The emended Kirschberg Evaporite ranges from 40 to 80 feet thick. It is present throughout the map area and shows very little lithologic variation. Type locality is the Cherry Mountain area north of Fredericksburg, in the vicinity of locality 6. The lowest stratigraphic occurrence of the breccia is over the axis of the Central Texas Platform, but at its widest extent the breccia appears as a thin sheet-like deposit that covered the entire platform. Thus the evaporite appears to have expanded outward through time (Fisher and Rodda, 1967, p. 57).

Segovia Formation (New)

The Upper Unnamed Formation of Lozo and Smith (1964) is here named the Segovia Formation.

The type section (Joy Creek composite section, Appendix C) was measured in new highway road cuts of Interstate Highway 10 from 5 to 10 miles southeast of the old settlement of Segovia, eastern Kimble County, Texas.

The Segovia Formation is lithically heterogeneous, consisting in general of marly limestone toward the bottom, dolomite and collapse breccia in the middle, and miliolid and mollusc-fragment biosparite toward the top. Considered as a gross unit, it is lithically similar to the Fort Terrett. Unlike the Fort Terrett, however, which is subdivided into four intergradational members, the Segovia is for the most part subdivided on the basis of thin, distinctive, widespread key beds that are readily recognized on aerial photographs. These are the *Gryphaea* Bed (Curry, 1934), Orr Ranch Bed (new informal name), and Black Bed (modified after Calvert, 1928).

In the western part of the map area dolomite and collapse breccia become less common in the Segovia, and farther west, in Sutton County, the Segovia interval consists mostly of thick beds of rudist and miliolid limestone separated by substantial intervals of ammonite-bearing marl. These rocks reflect a somewhat more marine origin and probably should be given a formal name to distinguish them from the Segovia. At any rate "Segovia" is intended to refer to the heterogeneous but generally dolomitic sequence above the Fort Terrett and below the Del Rio or Buda. It probably should not be used west or north of the map area; its southern and eastern limits of applicability are, respectively, the Devils River belt and the wide gap between the Balcones fault zone and the Edwards outcrop of Blanco and Kendall counties. "Person" rather than "Segovia" should be used in the Balcones fault zone. Segovia, rather than Santa Elena or Sue Peaks (Maxwell et al., 1967), should be used in the eastern Edwards Plateau for the "Upper Unnamed Unit" of Lozo and Smith for the same reasons that Fort Terrett, rather than Del Carmen, should be applied to their "Lower Unnamed Unit" (*see* p. 30). The difference in genesis is even more striking, however: The Santa Elena—Sue Peaks sequence reflects open-marine deposition and normal salinities, whereas the Segovia represents restricted circulation and elevated salinities in a very shallow shelf interior.

The overall similarity of the Segovia and Fort Terrett Formations justifies, indeed demands, the use of Edwards Group to refer to the whole carbonate mass in the eastern Edwards Plateau (*see* p. 18). Accordingly, the proposition of Moore (1967, pp. 61, 69) that the term Edwards be applied only to the lower unit (= Fort Terrett) as far south as the Devils River belt is rejected (*see* p. 17).

Thickness of the Segovia can be established only in the western part of the map area where the top of the member has not been eroded, but isopachous mapping (fig. 23) in that area shows the Segovia to be a wedge that thickens southward from about 230 feet at Fort Terrett to more than 360 feet along the northern edge of the Devils River trend. A generalized lithic succession is shown in figure 24 and, except for special emphasis, the rock sequence will not be further amplified here.

As in the Fort Terrett, dolomite content of the Segovia seems to be related to areas now structurally high, and the Medina axis and south flank of the Llano Uplift are clearly reflected by dolomite percentages in the member.

Burt Ranch Member (new).—A persistent and widespread zone of marly limestone was informally designated the Dr. Burt zone by Pavlovic, Hazzard, and others (*see* p. 14). As used by all workers, the term Dr. Burt referred only to a thin, soft, fossiliferous marl just above the porcellaneous micrite of the uppermost Kirschberg. There is, however, a widespread interval of generally marly limestone about 60 feet thick above the Kirschberg (Pl. 12, D), for which the term Burt Ranch Member is here proposed, which includes at its base the thin Dr. Burt zone of traditional informal usage. The base of the member is placed at the lowest marl above porcellaneous micrite breccia; the top is ordinarily drawn at the base of a resistant miliolid biosparite bed beneath thick grayish-brown dolomite beds.

The Burt Ranch Member consists generally of marl, marly micrite, miliolid biosparite, and rudist biosparite, with a few scattered beds of soft massive dolomite. Clayey or marly fossiliferous zones are particularly common near the base and toward the top and contain *Exogyra texana*, *Lunatia* sp., turritellid snails, *Enallaster* sp., heart clams, *Cyprimeria* sp., and rare oxytropidoceroid ammonites. The unit weathers to form a topographic bench with a tree-line just below the base, but it is not an outstanding air-photo map unit, and photo-mapping must be ground-checked at fairly close intervals to insure accuracy. The bed is farmed in the eastern part of the area. The type locality is locality 9 (Appendix D), on the upper reaches of Chalk Creek about 11 miles south of Junction (Pl. 12, C and D). This is part of the old Dr. Fred Burt ranch and in 1967 was part of the Tomlinson lease.

According to Lozo and Smith (1964, p. 291 and fig. 8) and Moore (1967, p. 68) the base of the Dr.

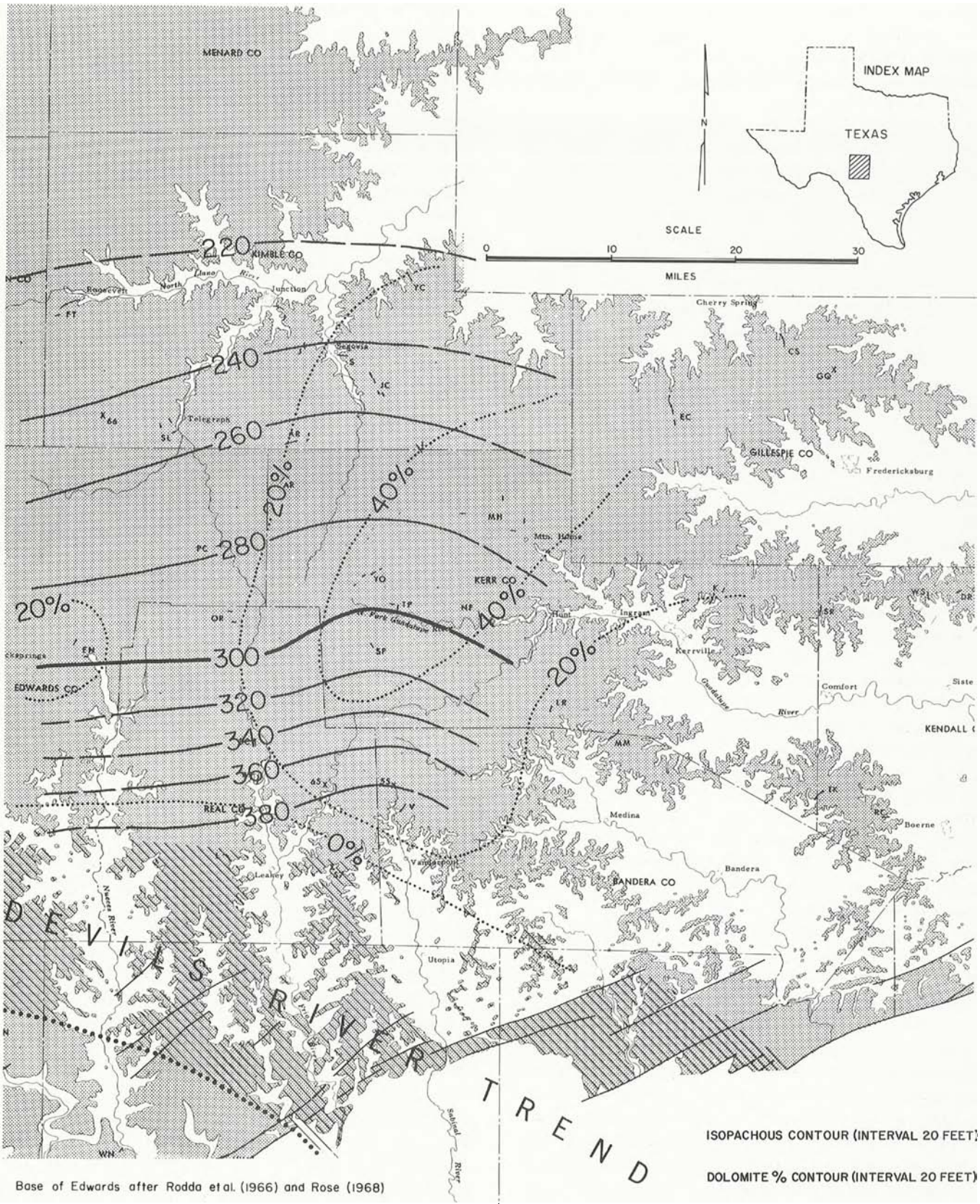


FIG. 23. Isopachous and dolomite-percentage map, Segovia Formation.

Burt zone is a disconformity; cited evidence is that the top of the Fort Terrett is an abrupt lithic boundary or discontinuity surface (Jaanusson, 1961) that is in many places iron-stained, bored by rock-boring molluscs, and plastered with oysters. On the other hand, the erosional nature of the contact is not proven because no rock or biostratigraphic units are missing at the interface.

The chief assumption for ascribing bored surfaces (or discontinuity surfaces) to subaerial exposure has been that shallow *submarine* lithification of carbonate sediment is not possible (Jaanusson, 1961, p. 231), and that matrix material must have been lithified in order to have been bored or attached-to by oysters. Recent discoveries by Ginsburg, Shinn, and Schroeder (1967) of submarine-cemented modern shallow-water carbonate sediment off Bermuda, by Fischer and Garrison (1967) off Barbados, by Taft (1968) in the Bahamas, and by Land and Goreau (1969) off Jamaica, cast serious doubt on that assumption. Moreover, Shinn (1969) has found successions of bored, submarine-cemented beds in the Holocene of the Persian Gulf.

Correlation of 20 measured sections (fig. 25) and geologic mapping between them shows that a single continuous discontinuity surface does not lie everywhere at the base of the Dr. Burt zone. Nearly all limestone/marl contacts within the Burt Ranch Member are abrupt, but there are commonly two or three such contacts at each outcrop, not just one. Many such interfaces are iron-stained, possibly as a result of different permeabilities to ground water or of modern weathering. Only a few of these surfaces are bored or attached-to by oysters. This evidence casts doubt on the existence of a single widespread surface of discontinuity.

Most bored surfaces are developed in particulate limestones that are overlain by marl. Bored surfaces are present a few feet below the Dr. Burt zone in the thin-bedded limestone of the upper Kirschberg (Segovia measured section), at the base of the Dr. Burt (Fort Terrett measured section and localities 14, 37, and 45), a few feet above the base of the Dr. Burt zone (Vanderpool section and localities 55 and 67), and near the top of the Burt Ranch Member (North Fork composite and Medina Mountain sections) (Pl. 11, C and D). At many localities (Mountain Home and Edwards Creek sections, localities 3, 9, and 25) no bored surface was found at all; at the Bee Caves Ranch section there are two, and at the Medina Mountain section three bored surfaces are present. The relations of all these surfaces are shown in figure 25.

The foregoing relations suggest conflicting conclusions: either (1) that occurrences of subaerial exposure and lithification were frequent and widely scattered; or (2) that submarine cementation was a continuing process, related perhaps to sediment type.

Examination of individual bored surfaces themselves also indicates that submarine cementation was involved in their formation (Rose, 1970). Individual borings are filled with very pure fine lime mudstone and pellet wackestone; the shells of the clams that made them are still present in some of the borings (Pl. 13, C). The perimeters of the borings are typically iron stained and they truncate shell fragments in the host rock, showing that the matrix was indurated when bored. Upon examination of bored surfaces in both plan and cross-sectional view, multiple periods of borings can be recognized based upon successive truncation of earlier borings by subsequent borings (Pls. 11, C and D; 13, C). Such superimposed or "bored borings" have been recognized by Shinn (1969) and Purser (1969) as characteristic of submarine-cemented carbonates. As they pointed out, "bored borings" must call either for on-going submarine lithification or for extraordinary oscillation of relative sea level so as to allow for repeated alternations of: (1) submergence and boring, and (2) subaerial exposure and lithification of the sediment that fills the boring. The reader will recognize the same conflict mentioned in the previous paragraph.

No "inverted borings" such as those described by Shinn and Purser were observed, but closely spaced successions of bored beds similar to those observed by Shinn in the Persian Gulf were found at the Medina Mountain section.

It can be clearly demonstrated (p. 56) that unbored, unstained limestone beds high in the Kirschberg were lithified, beveled, and brecciated before still higher Kirschberg limestone beds were deposited, and certainly long before the proposed regional exposure and lithification of Lozo and Smith (1964) and Moore (1967). So, again, either subaerial exposure occurred frequently, or these beds were indurated by a submarine lithification process.

It seems more harmonious with the observed facts that these beds were lithified by submarine processes and bored during periods either of nondeposition or of submarine exposure and lithification. Nevertheless, even if the subaerial interpretation of bored surfaces is accepted, repeated and sporadic local subaerial exposure in very shallow

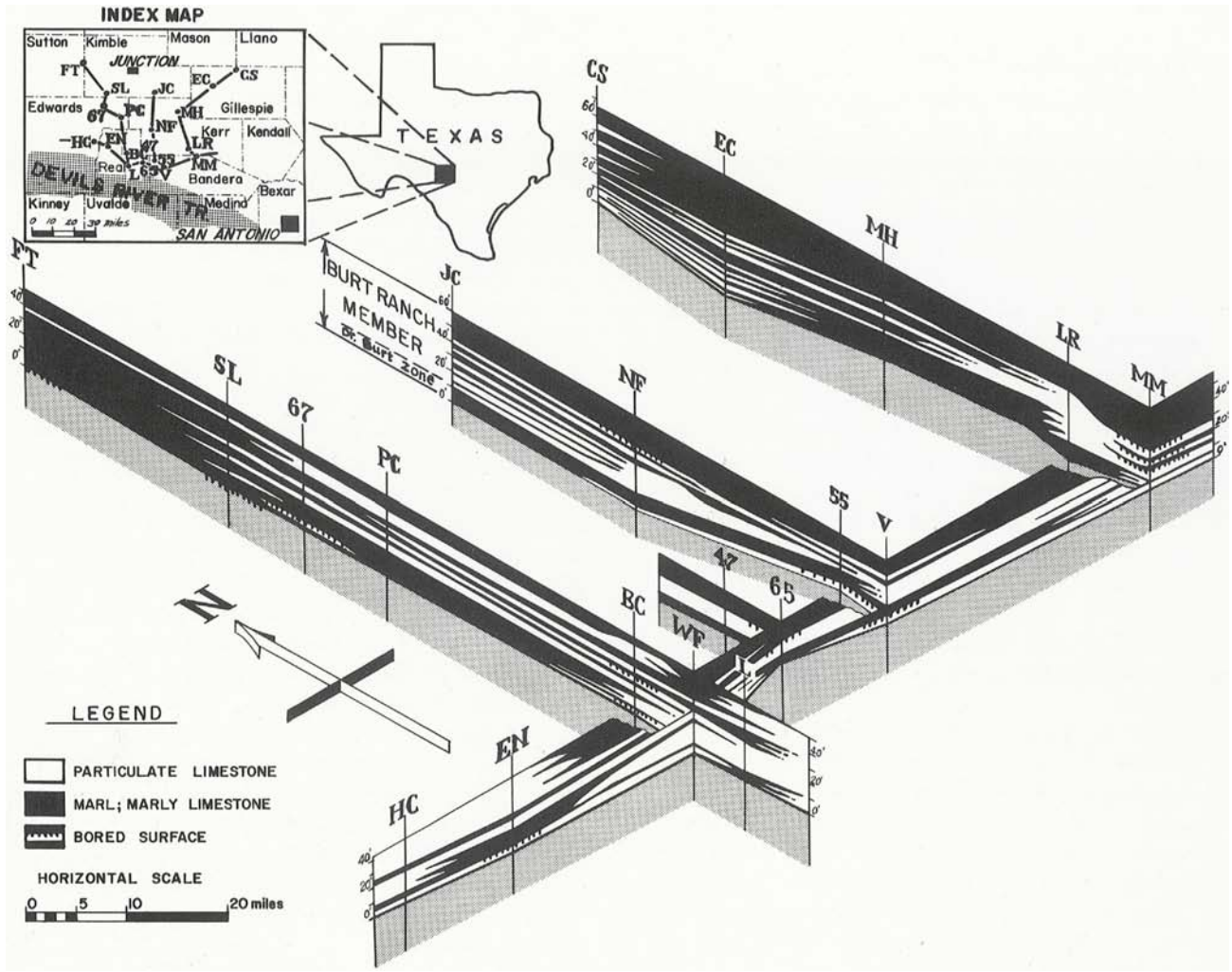


FIG. 25. Panel diagram showing limestone-marl relations within the Burt Ranch Member and distribution of bored surfaces.

environments of carbonate deposition should be the rule rather than the exception, and in a unit such as the Edwards, many discontinuity surfaces at different stratigraphic levels and of different temporal significance should be expected as a matter of course (fig. 25).

Two lateral variations are apparent in the Burt Ranch Member (fig. 26). It becomes thinner southward toward the Devils River belt, and it acquires increasing quantities of particulate limestone southward and eastward. Both tendencies probably reflect shallower water to the south and east. Toward the east the chief addition of limestone seems to be as thin beds of miliolid biosparite (Pl. 12, B), intrasparite, and biomicrite in the lower part of the unit (*see* Edwards Creek section). Towards the south, however, particularly in proximity to the Devils River belt, an irregular rudist and miliolid biostrome develops in the middle of the Burt Ranch Member (Pl. 13, D). The trend of the northern edge of this middle limestone layer is shown in figure 26.

At the Louis Real section this middle limestone layer is 33 feet thick, but over most of southern Kerr and northern Real counties it is 15 to 25 feet thick. At the Tommy Priour segment of the North Fork composite section in western Kerr County, drape or accretion beds that dip about 5 degrees south are present at the top of the middle limestone layer (Pl. 13, A), and at locality 61, about 3 miles southeast, similar large-scale inclined beds can be seen in bluff exposures along the North Fork of the Guadalupe River (Pl. 13, B). The top of this middle limestone is a red-stained, bored surface at the Medina Mountain and Bee Cave Ranch sections Pl. 11, C and D).

Two anomalous areas appear on figure 26. In the area around the Louis Real section, where the mid-

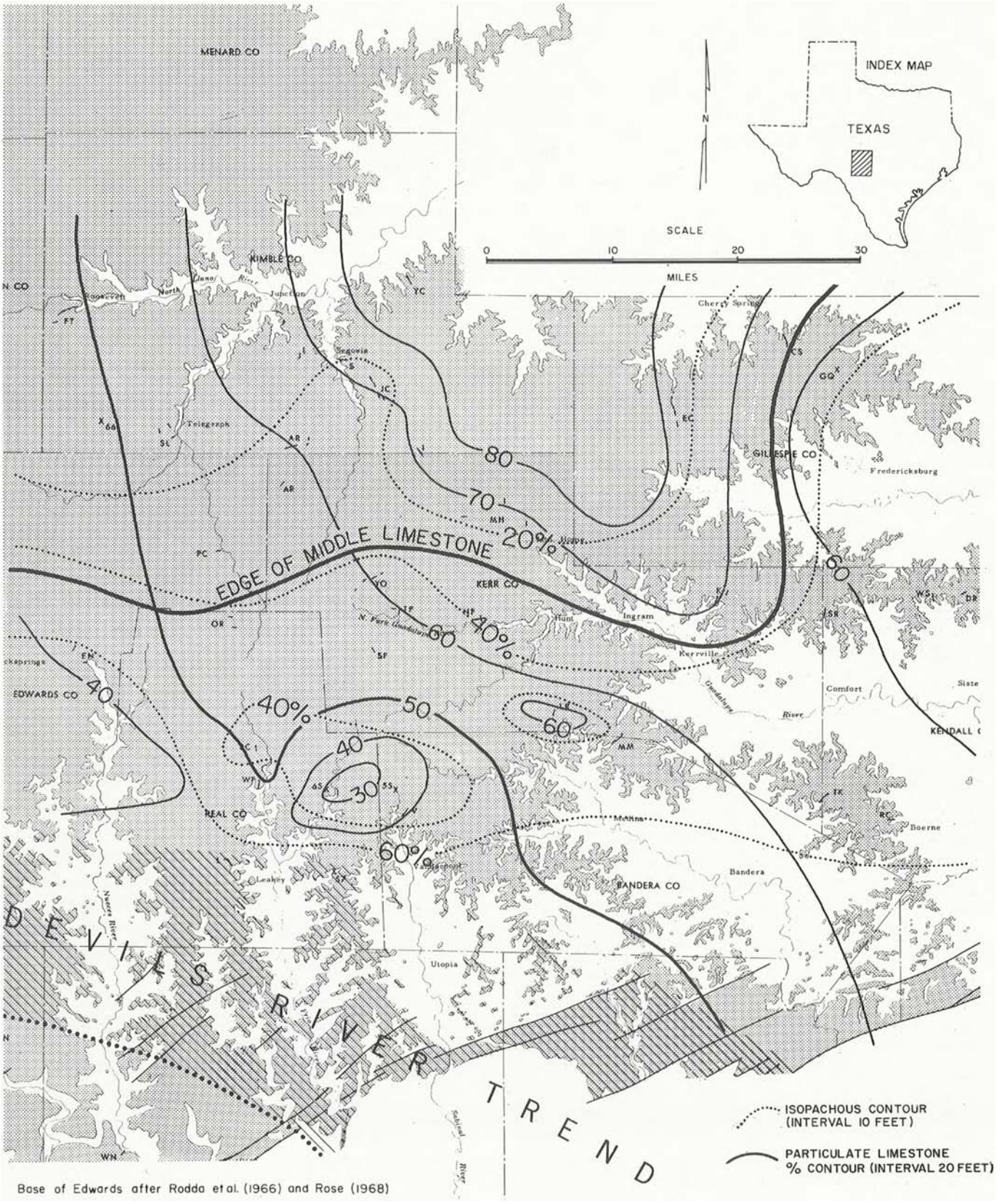


FIG. 26. Isopachous and particulate limestone-percentage map, Burt Ranch Member.

dle limestone bed is quite thick and reefy, the total Burt Ranch Member is unusually thick and contains a high proportion of particulate limestone. Near the Vanderpool section and localities 47, 55, and 65, the member is thin and contains a low proportion of limestone. Both localities lie on the Medina axis, suggesting that it was active during deposition of the Burt Ranch.

Where the Burt Ranch Member is not recognizable, the Fort Terrett and Segovia Formations are no longer readily separable and the entire rock mass is called Devils River Formation (Lozo and Smith, 1964, fig. 8). Three closely spaced sections (Bee Caves Ranch, West Frio, and Leakey) indicate the nature of the southward stratigraphic changes in the member as it disappears into the Devils River mass (fig. 25 and Pl. 4). Limestone beds become increasingly prevalent southward, particularly in the middle and lower part of the Burt Ranch, until only a thin marly zone is present near the top. Rudist and miliolid beds next intervene in this upper marly zone and ultimately occupy the Burt Ranch interval completely just south of the Leakey section. Similar changes appear to take place along north-south lines of cross section farther east (fig. 25).

The Burt Ranch Member represents distinctly more marine depositional conditions than the underlying Fort Terrett. The rich and diverse mollusc fauna with scattered ammonites indicates deposition on a shallow open shelf. Young (MS.) showed that clayey rock units in the Comanche Series tend to contain cosmopolitan rather than endemic ammonite faunas. He interpreted this to mean that argillaceous rock units, particularly the widespread ones, represent times of relative flooding, when there was communication between shallow seas on the Comanche shelf and the open ocean. This generalization suggests that the Burt Ranch Member is a marine transgressive unit of minor rank, and that the limestone beds contained within it formed in more agitated marine waters that prevented accumulation of clay. In this context it is significant that in the Burt Ranch Member, limestone tends to be more prevalent over the areas that were topographically or structurally highest, such as the Llano Uplift, Medina axis, and Devils River high.

There is a second implication worth mentioning. Inasmuch as carbonate production (and commonly accumulation) tends to be inversely proportional to water depth (Rose, 1963, p. 62), and suspended terrigenous clay tends to retard production of organic carbonate, it follows that accumulation should have been relatively slower for Burt Ranch marl than for limestone. This is in harmony with the previous suggestion that the widespread bored surface reported by Lozo and Smith, and Moore, represents a period of submarine nondeposition when deepening waters flooded the Central Texas Platform. Moreover, it is compatible with Shinn's (1969) hypothesis that submarine cementation requires slow accumulation rates.

Allen Ranch Breccia (new).—Above the Burt Ranch Member and below the *Gryphaea* Bed is an interval of cherty dolomite and thin-bedded siliceous micrite 50 to 80 feet thick. East of a north-south line through Junction, this unit contains an irregular, discontinuous collapse-breccia here named the Allen Ranch Breccia (fig. 27). The name comes from exposures on the Allen ranch, just east of U. S. Highway 83 in the bed of Allen Creek, southern Kimble County, but the type locality is in new road cuts of Interstate Highway 10, 1 mile northwest of the intersection of U. S. Highway 290 and Interstate 10 (Pl. 14, A and B). The breccia contains limestone, dolomite, and chert fragments, and the matrix commonly consists of fine-crystalline limestone, probably dedolomite. The Allen Ranch Breccia is thickest at the type locality—22 feet—but a collapse breccia in road cuts of U. S. Highway 83 just north of locality 55 at approximate Allen Ranch level appears to be somewhat thicker. Although no gypsum has been found at Allen Ranch level, the breccia was presumably formed by solution and removal of gypsum, like the Kirschberg breccia.

At approximate Allen Ranch level in the Bee Caves Ranch section, well-formed, presumably algal hemispheres about 1 foot across can be seen in the road cut (Pl. 14, C). The mounds are evenly spaced, and micrite drapes and ripples fill the intermound areas. Similar mounds were not seen elsewhere.

Gryphaea Bed (informal).—The *Gryphaea* Bed is a key bed marker in the middle of the Segovia Formation. On air photos it is expressed as a persistent line or double line of heavy vegetation with a broad grassy slope above and a steeper, less open slope below. It is the most prominent mapping unit in the area.

At the outcrop the *Gryphaea* Bed consists of one to three resistant beds of oyster biomicrite 6 inches to 2 feet thick that weather out at the foot of a covered slope. Many of the shells are superficially silicified and weather so as to stand out in sharp relief from the softer matrix (Pl. 14, D).

The *Gryphaea* Bed disappears along an irregular east-west line parallel to and about 20 miles north of the Devils River trend (fig. 27). The character of the bed remains constant to within

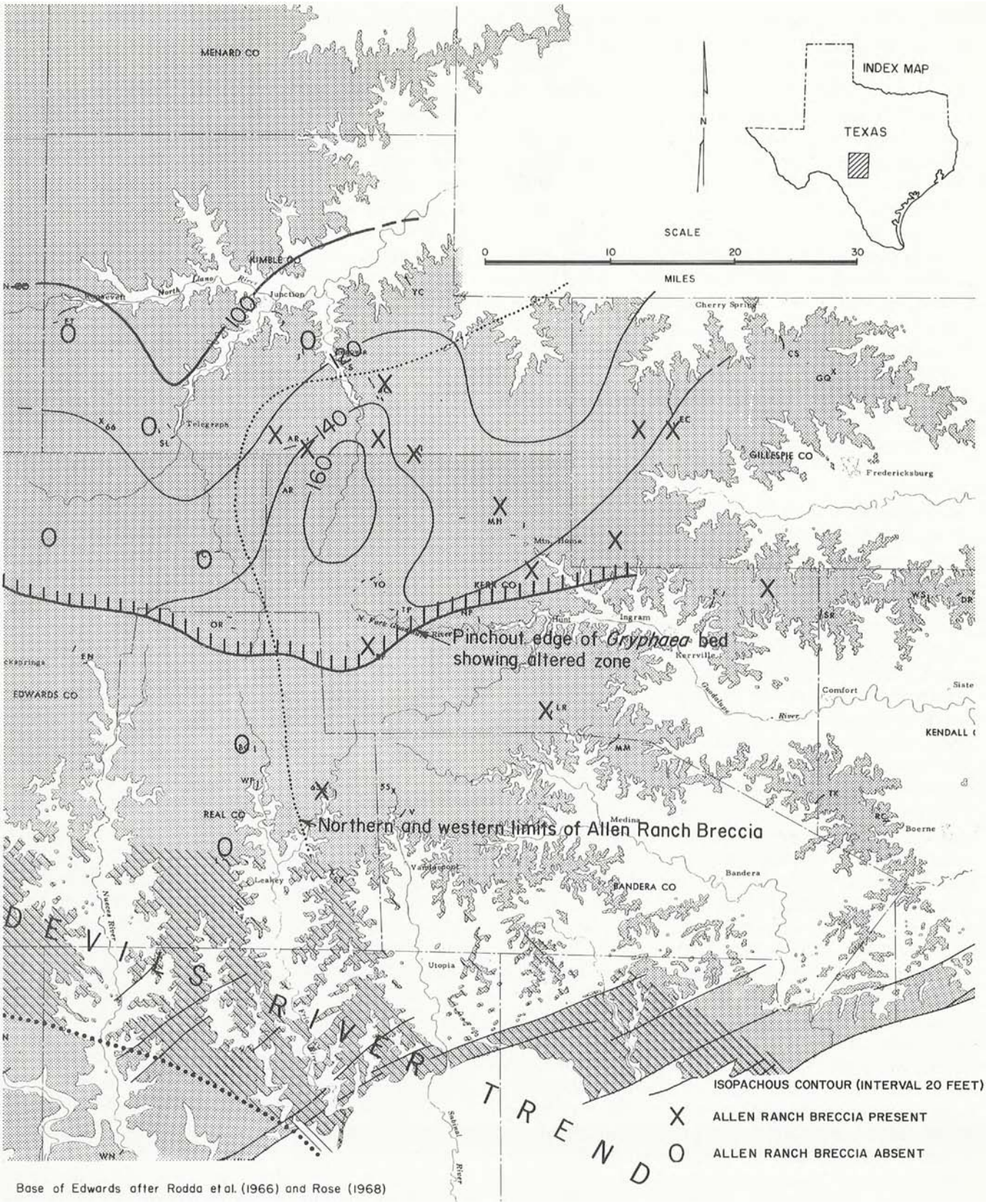


FIG. 27. Map showing thickness distribution of interval: base Burt Ranch—*Gryphaea* Bed, pinch-out of *Gryphaea* Bed, and distribution of Allen Ranch Breccia.

a mile or two of the line of disappearance, where the bed becomes thinner, dolomitic, and cherty. Immediately south of the line of disappearance massive beds of *Toucasia* biomicrite are present at the level of the *Gryphaea* Bed. It is interpreted that the *Gryphaea* Bed disappears by pinching out against low banks on the north flank of the Devils River trend, and that the narrow band of alteration north of the pinch-out line was produced by early exposure of the thinning bed on low mounds.

At localities 27 and 44 limestone- and chert-pebble conglomerate (Pl. 15, A) is found at the level of the *Gryphaea* Bed, which probably represents Cretaceous caliche. Many pebbles are coated and the matrix is identical to modern and fossil caliches.

Over all but the southwestern part of the area, the covered slope above the *Gryphaea* Bed is developed upon soft, massive dolomite and dolomitic limestone, but at the Orr Ranch section the interval consists of massive, soft, slightly recrystallized micrite.

Orr Ranch Bed (informal).—This is an informal name for a mapping unit identified primarily from its air-photo characteristics. The Orr Ranch Bed forms a prominent light outcrop band in a limited area in northern Real and southwestern Kerr counties. At the outcrop this band is a bare, covered slope developed on crystalline limestone, dolomite, and calichified marl. Type locality is the Orr Ranch measured section, W. E. Orr ranch, northern Real County. Just below the Orr Ranch Bed is a prominent massive ledge of limestone with abundant caprinids, *Toucasia*, and *Chondrodonta*. This ledge ranges widely in thickness and composition; locally, it is a distinctive mapping unit, but because of lateral changes and poor expression in flat areas it cannot be utilized readily as an area-wide mapping horizon. This caprinid zone is indicated on cross sections 40, 41, and 42. Small silicified caprinid mounds are found throughout the map area at this level (localities 4, 22, 42, 43). These mounds commonly support a flora different from that of surrounding areas and can be recognized from afar by post-oak trees, very tall range grass, and reddish soil. Large silicified caprinids and nerineid snails are the most common fossils (Pl. 15, B). The size of the caprinids in the silicified mounds increases southward toward the Devils River trend. Unfortunately, both matrix and fossils are silicified, rendering liberation of fossils by acid etching impossible.

Petrified wood is common throughout the eastern Edwards Plateau (localities 5, 29, 41) and nearly all is found weathering out of slopes just above the level of the Orr Ranch Bed. Indeed, large fragments of petrified wood are usually scattered about the headquarters of almost every ranch whose pastures lie at this level; the wood is found in pastures by ranch workers and carried in as a curiosity. Size of fragments ranges generally from hand-size fragments to logs 18 inches across and 4 feet long. At locality 41 in western Kerr County a tree trunk 24 feet long and 12 to 18 inches in diameter is weathering out of deep soil as a series of segments on a low hilltop. Although no wood has been found in place in the Segovia, its ubiquity at a single stratigraphic horizon indicates that it is indigenous to that level, not residual from higher formations now eroded away, or of Pleistocene origin, and that there must have been significant areas of land nearby during deposition of the upper Segovia. Whether the forests grew on broad emergent areas, scattered islands, or a single large mass (the Devils River trend?) is not known. Barnes's (1952-1967, Geol. Quad. Map 15) report of *Teredo*-bored petrified logs from a locality at Orr Ranch level southwest of Harper indicates that the tree trunks were exposed to sea water.

Black Bed (informal).—The upper 40 to 60 feet of the Segovia Formation consists of medium- to coarse-grained miliolid and mollusc-fragment biosparite beds alternating with recessive, calichified, presumably marly intervals. Near the top of the Segovia is a prominent grassy bench (the "Calvert Slope") below a resistant massive rounded ledge of porous biosparite that supports a dense growth of juniper and shin oak. This combination shows clearly on air photos as a dense tree-line just above an open, pale strip. Distinctive nodules of dark-gray to black micrite containing caliche-filled cracks commonly weather out of the covered slope. This is the Black Bed (Pl. 15, C).

Ward et al. (1968) described black limestone nodules forming around the margins of shallow saline lakes on Isla Mujeres, Quintana Roo, Mexico, and attributed their origin to modern calichification and surface alteration in a reducing environment. The black color is thought to be chiefly the result of sulfate-reducing bacterial action. Ward (personal communication, 1969) pointed out that such material may provide indications of ancient exposure surfaces or disconformities.

Examination of Black Bed micrite from several localities indicates that the Black Bed occurs in several different habits, reflecting several different modes of origin or subsequent alteration. In part, the black micrite was emplaced during subaerial exposure and diagenesis: At locality 15, floors of solution cavities are coated with laminated black

micrite, which is overlain by horizontal layers of vadose silt (Dunham, 1963). Remaining voids in the solution cavities have been filled by sparry mosaic calcite. The black micrite laminae are roughly concordant with cavity floors, and in situ laminations are essentially horizontal. The highly rounded, smooth pebbles and cobbles characteristic of the Black Bed may also represent reworking by an ancient sea; bored black cobbles contained in coarse skeletal lime sand are associated with erosional surfaces at localities 16, 68, and 69 (Pls. 15, D; 16, A). The sporadic occurrence of the black micrite is harmonious with scattered hypersaline lakes, analogous to Ward et al.'s Yucatan example. Commonly, the black micrite is emplaced in caliche, but whether this caliche is Cretaceous or modern is not yet determined. Finally, comparison of Black Bed micrite and Ward's black micrite suggests that they are sufficiently similar to have formed in similar ways. Particularly striking is the fact that grains and crystallites in both rocks are coated by a thin black film that is probably responsible for the opacity of the rocks. Organic carbon analyses, however, indicate that concentrations of organic carbon are so low that some factor other than organic carbon must be responsible for the dark color.

Isopachous mapping (fig. 28) of the interval between the Black Bed and the top of the Segovia shows considerable irregularity and suggests the possibility of truncation of uppermost Segovia beds only one place, about 2 miles northwest of Garven Store, does the Black Bed itself appear to be truncated, but obscure field relations there prohibit certainty (*see* Pl. 1). At several places, however (localities 19 and 69), the Black Bed lies only 2 or 3 feet beneath the overlying Del Rio. More commonly it is 10 to 20 feet below the top of the Segovia, but southwestward toward Rocksprings the interval between the Black Bed and the top of the Segovia thickens regularly, and an interval of 54 feet was measured 3 miles northeast of Rocksprings. An alternative interpretation is that this irregularity is the result of the disconformity associated with the Black Bed, and that uppermost Segovia beds lap onto an irregular erosion surface developed upon the weathered and altered "Calvert Slope" sequence.

Del Rio Clay and Buda Limestone

Only a thin veneer of Del Rio is present in the map area; it is usually poorly exposed, but some quarries and caliche pits provide good outcrops. It consists of yellowish-brown, soft calcareous clay containing thin reddish-brown silty streaks and coquinoid lenses of the small oyster *Exogyra arietina.*

Figure 29 shows the thickness pattern of the Del Rio. It is thickest—9 feet—at the easternmost outcrop in the area (YO section) and probably thickened to the east and south. At one of the northernmost Del Rio outcrops, on the W. E. Allen ranch in southern Kimble County, the formation is present only as an *Exogyra arietina* coquina less than a foot thick. Westward the Del Rio thins regularly and pinches out beneath the Buda in northwestern Real County. A probable regolith is present between the Del Rio and Buda at locality 18 just east of the pinch-out (Pl. 16, D). At locality 17, about 10 miles west of the pinch-out, Buda limestone containing bored pebbles of brown Del Rio siltstone rests unconformably upon the Segovia (Pl. 16, B and C).

The Buda consists of compact nodular micrite and mollusc-fragment biomicrite with marly interbeds (Pl. 16, E). The top of the formation is not present in the map area, but northwest of Rocksprings where it is overlain by the Eagle Ford Formation the Buda is 20 to 30 feet thick. The Buda weathers to produce on air photos a distinctive finely mottled pattern with a grassy calichified halo or "racetrack" around the periphery of Buda outcrops. The formation is nearly always covered, and the only good Buda exposures are found in road cuts or caliche pits.

Top of the Edwards

In the western part of the map area, where Buda rests on Edwards, the boundary is clearly a disconformity (Pl. 16, B and C). The Del Rio—Buda boundary must also be disconformable because of the eroded Del Rio pebbles contained in the basal Buda, the previously mentioned regolith, and the regional truncation of Del Rio by Buda.

The Del Rio—Edwards boundary, however, is another question, for the geometric relations between Edwards, Del Rio, and Buda could be produced by a single disconformity, at the base of the Buda. The boundary represents a distinct regional lithic change from carbonate to terrigenous rock, and in some good exposures (locality 41 near Garven Store) it is an iron-stained bored surface. According to Lozo and Smith (1964, p. 281) this boundary is a "major disconformity," exhibiting truncation of the underlying beds and onlap of the overlying formation, but they cite no specific evidence. The writer believes that the previously discussed irregularity of the interval between Black Bed and top

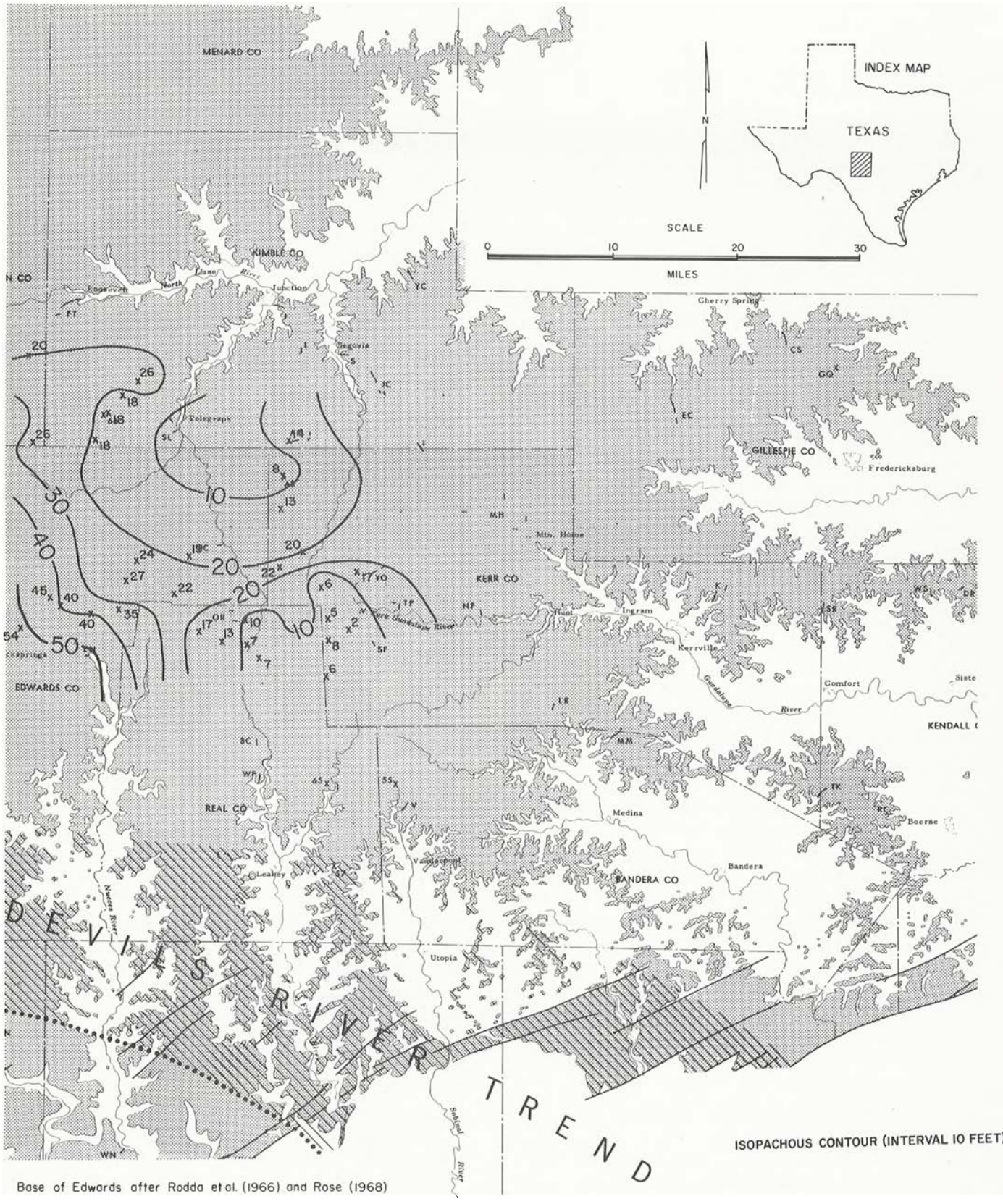


FIG. 28. Isopachous map of interval: Black Bed—top Segovia Formation.

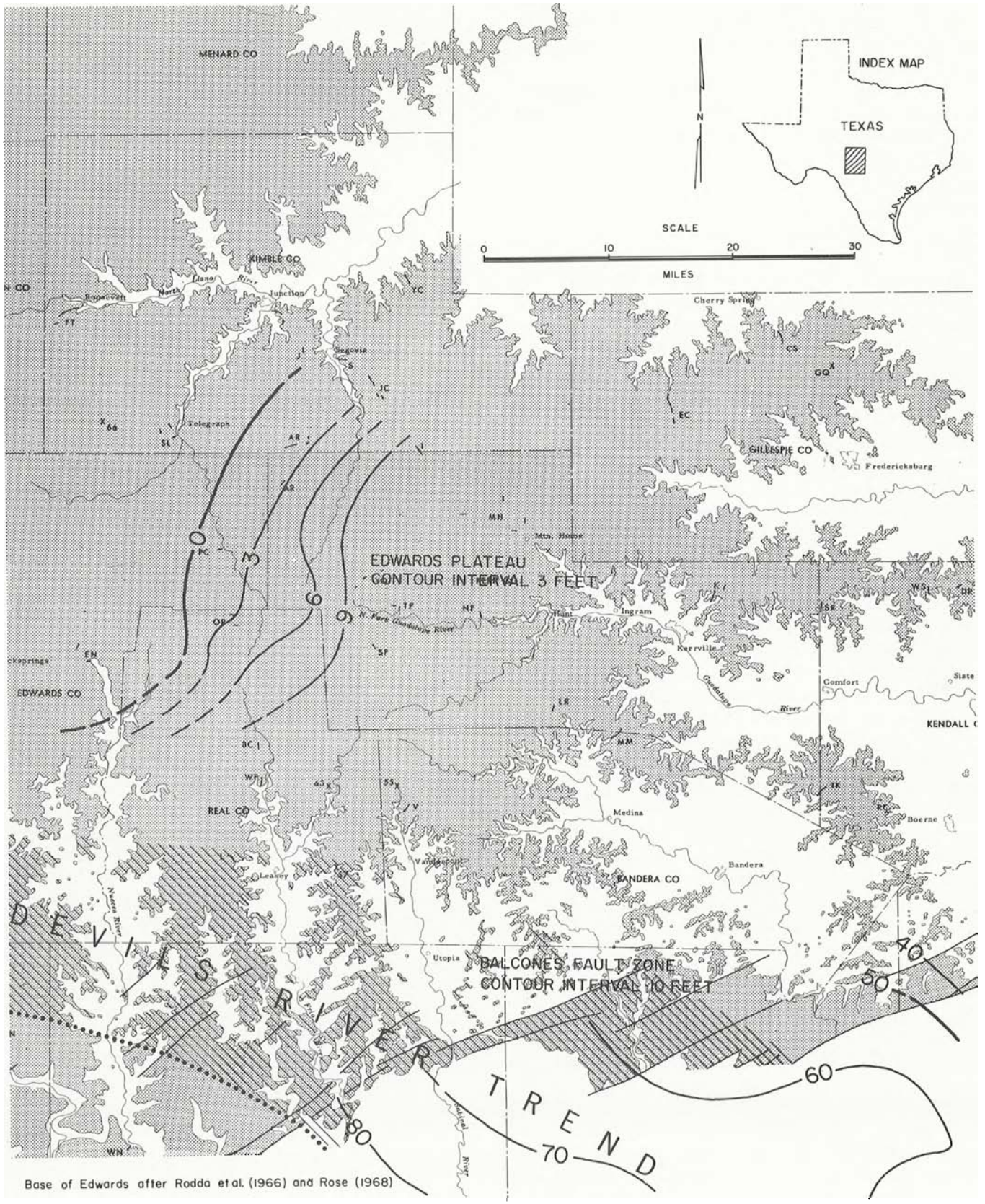


FIG. 29. Isopachous map, Del Rio Clay.

Segovia can be accepted as valid evidence of discordance between the Del Rio and Edwards, particularly in light of the other evidence, and recognizes the boundary as probably disconformable.

The reader is reminded that precisely the same geometric and stratigraphic relations between the Buda, Del Rio, and underlying limestone were also observed in the subsurface, in the DuBose Field area (*see* fig. 13).

Lateral Stratigraphic Relations

Plate 4, A and B, are stratigraphic cross sections that summarize the relations of Fredericksburg and Washita rocks in the eastern Edwards Plateau.

Lozo and Smith (1964, fig. 8) presented a cross section showing the basic relation between the Devils River Formation and the two then-unnamed units to the north (now Fort Terrett and Segovia). It should be emphasized that their cross section was the result of reconnaissance work, not detailed investigation.

The cross section of Plate 4, A, has a similar surface trace, utilizing two of Lozo and Smith's measured sections, Fort Terrett on the north and Leakey Roadcut on the south. It was constructed to further document and define Devils River-Fort Terrett-Segovia relations and has, in general, confirmed Lozo and Smith's basic conclusions. Several modifications, however, should be mentioned:

(1) The Dr. Burt Bed *can* be identified in the Leakey Roadcut section (*see* p. 40) "caught in the act" of changing into the massive limestone of the Devils River.
(2) The Kirschberg Evaporite extends continuously from Fort Terrett into the Devils River Formation.
(3) The Leakey Roadcut section lies just south of the northern boundary of the Devils River Formation, not in the middle of the belt as Lozo and Smith showed. Present mapping also suggests that the northern boundary of the Devils River should be a mile or two farther south than Lozo and Smith's figure 6 indicates.
(4) Lozo and Smith's upper unit (Segovia) is more wedge-like than their section indicates, thickening from 230 feet (not 260) at Fort Terrett to about 380 (not 290) just north of the Devils River belt.

Plate 4, B, is a stratigraphic cross section that bears northeast from the Leakey Roadcut section in southern Real County to the Cherry Spring section in northern Gillespie County. This section is oriented normal to depositional strike, passing from the Devils River belt onto the axis of the Central Texas Platform. Like Plate 4, A, it shows the geometric relation of the several formations, members, and beds, but a number of other features appear that merit further discussion:

(1) The cross section lies far enough east to show clearly the large amounts of dolomite and collapse breccia in the Segovia that typify the formation. The previously mentioned wedge form of the Segovia can also be seen readily.
(2) Southward changes in Fort Terrett lithology and sequence are practically nonexistent, even as the member passes into Devils River; the Basal Nodular, Burrowed, and Dolomitic Members and the Kirschberg Evaporite are all readily identifiable in the Leakey Roadcut section. This is in sharp contrast to the Segovia Formation, which acquires more and more rudist beds approaching the Devils River belt (*see* Pl. 4, A).
(3) Lateral facies changes in the Burt Ranch Member are shown, from interbedded marl and miliolid biosparite toward the axis of the Central Texas Platform to marl in the Junction trough to rudist banks and miliolid biosparite on the Medina axis. The section also shows the southward thinning of the Burt Ranch. Passing southward into the Devils River trend, beds in the upper Fort Terrett do not change facies, nor do bioclastic mounds or bank-like deposits intervene at the top of the Fort Terrett. Furthermore, the southward thinning of the Burt Ranch is, in general, a gradual regional pattern. It is not accomplished by facies change at the base. Finally, the increase in particulate limestone in the member suggests southward shoaling. Accordingly, the southward thinning must be ascribed to gentle uplift of the Medina axis and Devils River trend during deposition, not to organic buildups near the Devils River trend.
(4) At the northeast end of the cross section, correlation of the Gypsum Quarry and Cherry Spring measured sections shows that recrystallized limestone, not collapse breccia, occupies the former position of gypsum, and that the Kirschberg is about as thick where gypsum is present as where it has been removed. Also the Kirschberg is seen to contain two persistent layers of breccia that are continuous from Cherry Spring to the Leakey Roadcut.

SURFACE-SUBSURFACE STRATIGRAPHIC RELATIONS

The chief aim of this project was to establish the relation between surface and subsurface stratigraphic units within the Edwards Formation. A stratigraphic cross section was prepared (Pl. 4, C) that crosses the area of surface mapping from northwest to southeast and connects to the previously discussed (pp. 24, 25) Selma core in northern Bexar County. The cross section shows that Fort Terrett stratigraphic units extend continuously across the eastern Edwards Plateau to the Selma well site. The reader is reminded that the Selma well is included in the regional subsurface cross sections (Pl. 3, C-C′ and F-F′) and is securely tied to the subsurface correlation network.

Because the chief accomplishment of this study hinges on the correct correlation of the Selma core and the nearest measured section at Turkey Knob, 40 miles to the northwest, it seems appropriate to discuss the two sections in some detail. As might be expected in comparing two Edwards sequences 40 miles apart there are many differences, but the two sequences are sufficiently similar to allow their correlation with considerable confidence. In particular the critical Kirschberg—Burt Ranch sequence is clearly recognizable in the Selma core:

(1) The incipiently brecciated lithographic to porcellaneous micrite so typical of uppermost Kirschberg is present in the Selma core from 477 to 480 feet.
(2) Above the porcellaneous micrite is 44 feet of miliolid biosparite with scattered streaks of wispy marl; this unit is overlain by 22 feet of nodular marl containing *Exogyra texana*, the subsurface Regional Dense Member. The entire 66-foot interval is the Burt Ranch Member. No bored surface was seen in the core.
(3) Below the porcellaneous micrite about 55 feet of very cavernous, altered, cherty, crystalline limestone was encountered from which core recovery was very poor. This interval corresponds to the Kirschberg Evaporite, which is similarly altered, porous, and cavernous at the outcrop.

Thin marly beds in the Selma core at 344 and 347 feet contain oysters, possibly *Gryphaea;* this bed lies at about the same position above the base of the Burt Ranch as does Curry's (1934) *Gryphaea* Bed—130 feet—but this may be coincidental; the nearest known outcrop of the *Gryphaea* Bed is 75 miles northwest.

The major differences between the Selma and Turkey Knob successions are:

(1) The Basal Nodular Member, though present, is quite thin and the lower boundary is not abrupt in the Selma core.
(2) Dolomite occurs stratigraphically lower in the Selma core than it does at Turkey Knob, whereas the part of the Selma core that lies at the level of the surface Dolomitic Member is generally nondolomitic and also contains one cavernous collapse breccia zone filled with red clay.
(3) The Fort Terrett interval seems somewhat thin in the Selma core, which was drilled in the Balcones fault zone. One or more of the cavernous intervals may be small fault zones.

It was previously emphasized (p. 38) that in the eastern Edwards Plateau, the Burt Ranch Member changes facies eastward by acquiring thin miliolid biosparite beds in the lower part, leaving the upper part marly, and southward by the intervention of thick rudist and miliolid beds in the middle and lower parts, again leaving the upper part marly. This pattern apparently continues southeastward so that the subsurface Regional Dense Member is a widespread marl in the upper part of the Burt Ranch Member (Rose, 1970). If so, the Grainstone Member of the subsurface Kainer Formation must be equivalent to the lower and middle Burt Ranch, including the Dr. Burt zone. The subsurface Dolomitic Member of the Kainer Formation is therefore equivalent to the entire Fort Terrett Formation. The reader is reminded of collapse breccias reported at the top of the Dolomitic Member in the Jolley and Mercer cores and in many Fashing-Person cores. These are almost certainly the same as the Selma interval identified as Kirschberg.

This indicates the error in the claim of Fisher and Rodda (1967, p. 55; 1969, p. 57, figs. 3 and 4) that the Dr. Burt zone and the Regional Dense Bed are equivalent. Their correlation caused them to include the dolomite-free Grainstone Member in their Edwards (sic) map unit and may account in part for the incorrect dolomite content they show for the subsurface Edwards (compare figs. 14 and 15 of this report; Fisher and Rodda, 1967, fig. 3; 1969, fig. 5; and Rogers, 1967, fig. 7).

Moreover, identification of the Kirschberg Evaporite in the Selma core means that the widespread collapse breccias in the upper part of the Dolomitic Member of the subsurface Kainer Forma-

tion must therefore be Kirschberg also. Accordingly, the area of Kirschberg deposition must have had much wider boundaries than the "Kirschberg lagoon" Fisher and Rodda showed (1967, figs. 1, 5, 12-13; 1969, figs. 1, 7, 10, 12-13) (*see* p. 17 this report). An alternate interpretation is that the Kirschberg Evaporite formed not in a shallow lagoon but as a sebkha-like tidal flat, similar to those of the Persian Gulf (*see* p. 17) that covered most of the interior of the Central Texas Platform.

The Dr. Burt Bed—Kiamichi (= Regional Dense Bed) relation was correctly anticipated on the basis of ammonites by Young (1966, p. 9, table 1).

Whether the Georgetown Formation disappears to the northwest by pinching out upon the Edwards or by changing facies to particulate Edwards-type limestone of the uppermost Segovia (above the Black Bed) is not certainly known. In the shallow subsurface of the San Marcos Platform the Georgetown is a thin, widely traceable marine limestone, commonly marly in the lower part; the interval from the Black Bed to the top of the Segovia could be described accurately in the same terms (*see* YO, Orr Ranch, Allen Ranch, and Fort Terrett measured sections, Appendix C), and the two intervals have similar thicknesses as well. Although outcrops of the Black Bed sequence are generally poor, evidence of a disconformity, or at least subaerial processes involved with the Black Bed—Calvert Slope, has been found at four localities (*see* p. 43). This possible disconformity may correspond with the well-documented disconformity at the base of the Georgetown, and the Black Bed itself may represent diagenetic emplacement under subaerial conditions, similar to modern black micrite described by Ward et al. (1968) in Mexico (*see* p. 42). If so, the "Calvert Slope" may be the ancient weathering profile across which uppermost Georgetown seas transgressed.

On the other hand, in the Balcones fault zone the Georgetown is 20 to 30 feet thick where it is overlain conformably by about 50 feet of Del Rio. On the Edwards Plateau, however, the Del Rio is less than 10 feet thick and its base probably is a disconformity. If positive movements on the Plateau were sufficient to cause that much thinning, and an erosion surface as well, it seems logical that the 20 feet of "uppermost Segovia-Georgetown" would have been eroded away. Even though the Black Bed—top Segovia interval thickens markedly in the western part of the area, to more than 50 feet, the unit does not acquire the open marine character typical of the Georgetown but retains its coarse bioclastic nature. After weighing these facts, the writer, in contrast with an earlier interpretation (Rose, 1968a), now believes that the "Calvert Slope" probably represents a Cretaceous weathering profile, that the subsurface Georgetown Formation probably changes facies northwestward to Edwards-type skeletal carbonates, and that the Black Bed—top Segovia interval is equivalent to the Georgetown of the shallow subsurface of the San Marcos Platform.

The fundamental stratigraphic relations between surface and subsurface Edwards are summarized in figure 30. Inasmuch as both top and bottom of the key Burt Ranch Member can be identified in subsurface cores, the reader may wonder why a new set of names and an arbitrary cutoff are needed. The answer is that the base of the Burt Ranch in the subsurface (= base of the Grainstone Member is not an easily identified mapping horizon, as previously pointed out. It does not have distinctive or consistent electric log characteristics, nor is it a sharp boundary on sample logs. But the base of the Regional Dense Member *is* such a boundary and has the additional advantage of being a division boundary as well. On the other hand, the base of the Regional Dense Member is not readily identifiable within the Burt Ranch Member at the outcrop—the useful mapping boundary there is the base of the Dr. Burt marl. The practical solution has been to recognize the lithic unity of the carbonate mass by assigning it to one group (Edwards) and to adopt different surface and subsurface formations separated by an arbitrary cutoff located just northwest of the Balcones fault zone.

The chief implication of figure 30 is that the terms Washita Division and Fredericksburg Division cannot be applied properly in the Edwards Plateau. Divisions are distinct cycles of sedimentation; where the cycle boundaries cannot be defined the division cannot be recognized. Tucker (1962b) demonstrated that on the San Marcos Platform, the "Edwards B-zone" or Kainer Formation was the Fredericksburg Division and that the "Edwards A-zone" or Person Formation belonged to the lower Washita, the base of the Regional Dense Member (= Kiamichi) being the division boundary. But no clear boundary is present at that level in the Edwards Plateau.

Because they are cycles of sedimentation, divisions are implicitly limited to tectonic-sedimentary regions, or basins of deposition, and their boundaries, obviously, must end somewhere. The Fredericksburg-Washita Division boundary ends just northwest of the Balcones fault zone and in the subsurface, along a line just east of the Maverick basin.

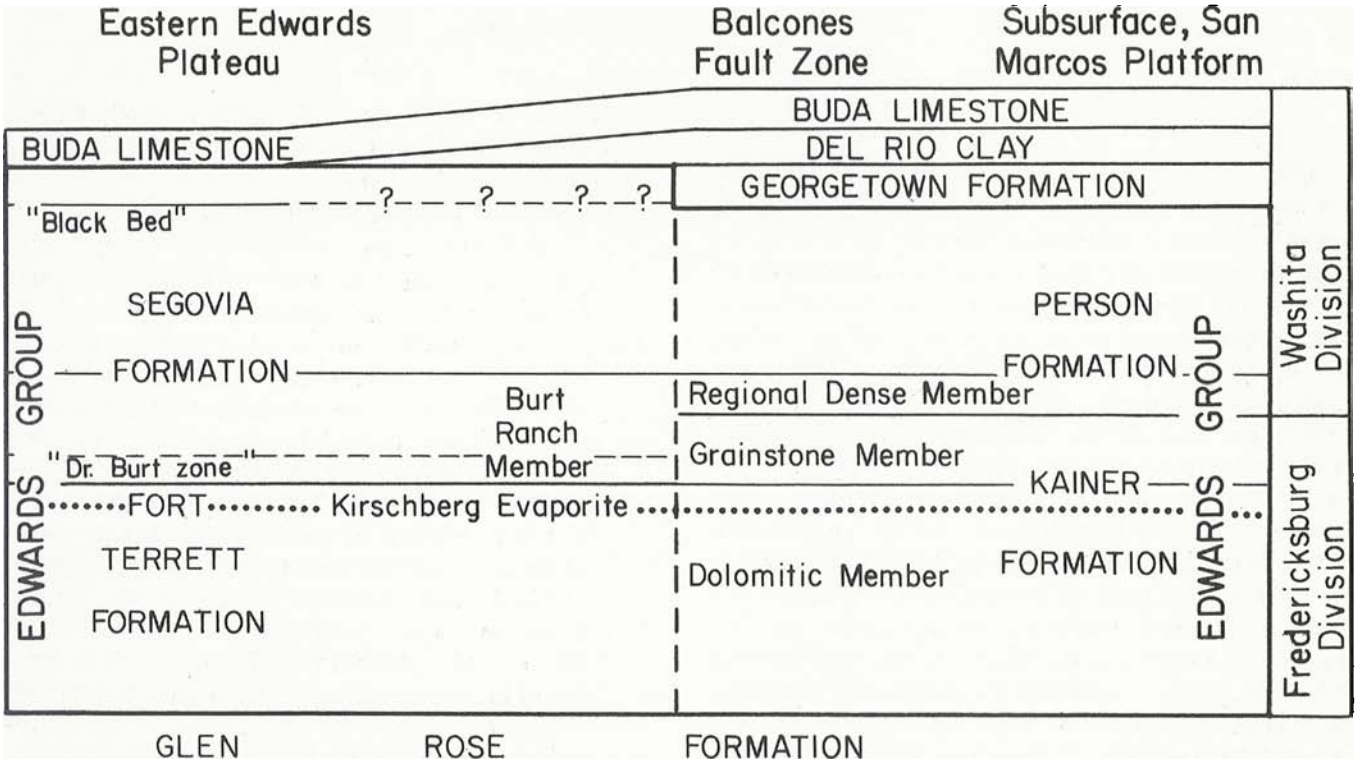


FIG. 30. Summary of surface-subsurface stratigraphic relations, Edwards Group, Central Texas.

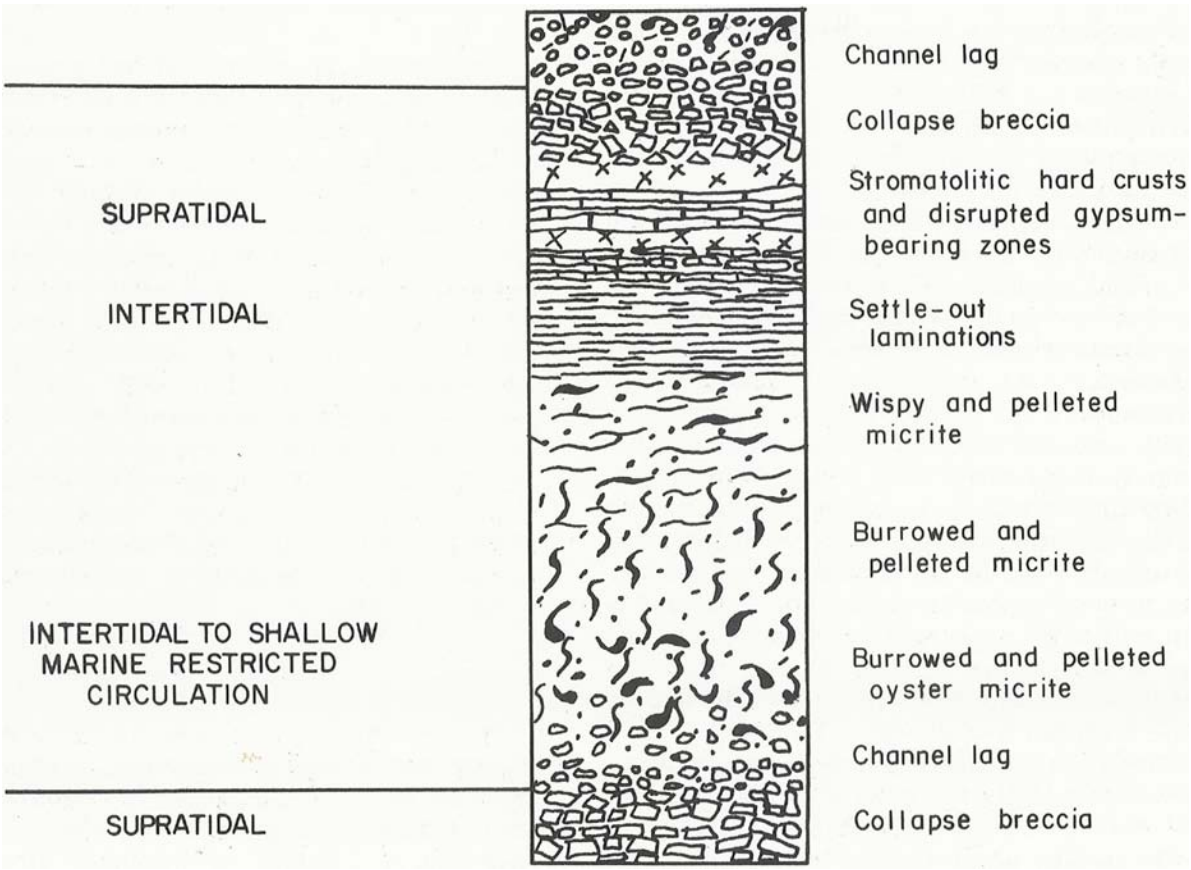


FIG. 31. Typical Edwards tidal flat cycle.

DEPOSITIONAL ENVIRONMENTS

SHALLOW-WATER DEPOSITIONAL MODEL

During the past 15 years many investigations of shallow-water sediments have been carried out in areas of modern carbonate deposition, such as the south Florida shelf (Ginsburg, 1956; Ginsburg et al., 1964), the Bahama Islands (Cloud, 1962; Illing, 1954; Imbrie and Buchanan, 1965; Newell et al., 1959; Purdy, 1963; Shinn et al., 1965), the Yucatan Peninsula (Folk and Robles, 1964; Kornicker and Boyd, 1962), and the Persian Gulf region (Evans et al., 1964; Houbolt, 1957; Illing et al., 1965; Kendall and Skipwith, 1969). Two important results have been (1) the recognition that a similar set of environmental belts is present in most carbonate realms, here called supratidal, intertidal, restricted shallow marine, open shallow marine, and open shelf; and (2) the recognition that certain textures, sedimentary structures, minerals, and faunal associations are characteristic of each environmental belt. Recently there have been several excellent studies that applied these principles successively to ancient carbonate rocks (Roehl, 1967; LaPorte, 1967; Fisher and Rodda, 1967, 1969), suggesting that these environments have persisted through geologic time. Table 2 attempts to synthesize the results of many of these studies into a depositional model.

Environments of deposition of Edwards and associated rocks have been interpreted using this model, which is presented so that the reader will have some basis for evaluating interpretations of environment made in this report. It should be referred to whenever the reader does not understand the basis for environmental "calls."

Several inherent difficulties or modifications should be reviewed:

(1) The end-members of the classification are usually distinctive and readily identified. Intertidal sediments, though possessed of fewer characteristic features, are nevertheless ordinarily distinguishable, in part by their association with supratidal sediments. Separating intertidal from restricted shallow marine and restricted shallow marine from open shallow marine is usually troublesome and the end result is subject to challenge.

(2) There is no inherent depth distinction between restricted shallow marine and open shallow marine. Both kinds of sediment accumulate in very shallow water, but the restricted environment is partly cut off from normal marine circulation. Commonly this involves proximity to physical barriers.

(3) The open shallow marine category can be subdivided into high- and low-wave energy categories according to sorting, grain size, grain features, and faunal content.

(4) A depth distinction is intentionally implied between the open shallow marine and open shelf categories. The distribution of planktonic Foraminifera on the Florida shelf and Bahama bank is apparently controlled by the (-)30-foot contour—foraminiferal faunas from shelf sediments deposited in less than 30 feet of water ordinarily contain less than 1 percent pelagic Foraminifera, whereas foraminiferal faunas from depths of about 200 feet frequently contain up to 20 percent pelagic species. This may be either an expression of sensitivity to changes in water chemistry or a reflection of life zones in the water mass, probably the latter.

FREDERICKSBURG AND WASHITA DEPOSITIONAL ENVIRONMENTS

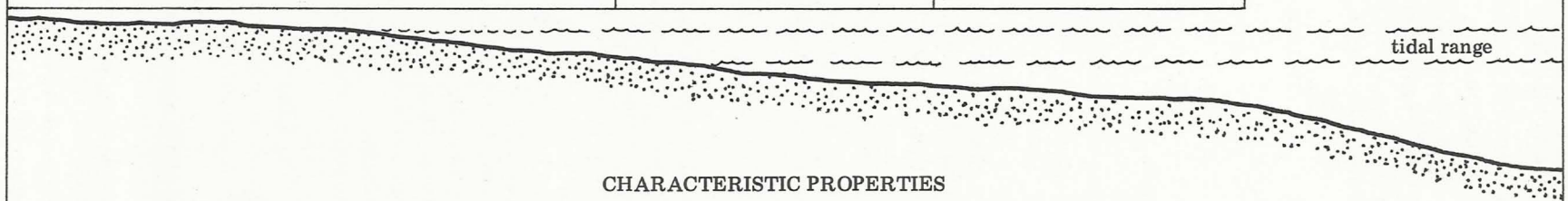
Nine major depositional environments recurred on the Comanche shelf through Fredericksburg and Washita time. These environments were controlled by the degree to which marine waters of normal salinity could circulate freely through the depositional area, by water depth, as it influenced light penetration and wave and current strength, and by terrigenous matter in the water. Two of the environments existed only briefly, produced by rather special conditions: the euxinic, evaporitic shelf basin that produced the McKnight Formation, and the evaporite-dominated high supratidal flat in which the Kirschberg and Allen Ranch Evaporites were deposited. The attributes of sediments deposited in the major environments, stratigraphic units in which they occur, and other pertinent factors such as geographic or tectonic setting are reviewed below.

Open Deep Marine

Thick, monotonous sequences of ordinarily dark, slightly argillaceous nondolomitic lime mud with common pelagic Foraminifera and without indigenous shallow-water fauna are characteristic of this environment. Pellets or fragments of reef-type

TABLE 2. *Classification of depositional environments.*

SUPRATIDAL	INTERTIDAL	SHALLOW MARINE		OPEN SHELF
(TIDAL FLAT)		RESTRICTED	OPEN	



CHARACTERISTIC PROPERTIES

SUPRATIDAL	INTERTIDAL	SHALLOW MARINE: RESTRICTED	SHALLOW MARINE: OPEN	OPEN SHELF
1. Hard crusts or stromatolites 2. Mud cracks 3. Root marks 4. Gypsum or gypsum pseudomorphs, etc. 5. Thin collapse breccias 6. Storm layers 7. Fauna sparse, not diverse; snails may be common 8. Not extensively burrowed 9. Common exposure surfaces 10. Mostly mud and pellets 11. Oxidized sediments—light-colored	1. Channel-lag deposits 2. Channel-edge slumps 3. Extensive burrowing 4. Settle-out laminations 5. Wispy structures 6. Cyclic grain-size fluctuation 7. Limited fauna—oysters, snails, 1-2 foram. spp. 8. Mostly mud and pellets 9. Darker-colored sediments 10. Association with supratidal sediments	1. Limited marine fauna, more diverse than intertidal, no pelagic elements 2. Extensive burrowing 3. Wispy structures 4. Mixed grain size, mud and sand 5. Low-energy ripples and current-streaks 6. No associated supratidal sediments	1. Diverse marine fauna without pelagic elements 2. Commonly coarse grain-size, good sorting 3. Evidence of high-wave and current energy—abraded shells, cross-bedding, ripple marks 4. Scattered local banks and mounds 5. No associated supratidal features	1. Diverse marine fauna with pelagic elements—*Globigerina*, ammonites, etc. 2. Commonly argillaceous 3. Even, regular bedding 4. Facies very widely extensive 5. Commonly fine grained

organisms may occur in small numbers, sometimes in graded beds. Geologic setting is seaward of the Comanche shelf edge in the ancestral Gulf of Mexico basin, and all Fredericksburg-Washita rocks seaward of the Stuart City Reef were formed in this environment.

Open Shelf

Dark to light, slightly argillaceous, nondolomitic lime mud with a diverse indigenous fauna including common pelagic Foraminifera, calcispheres, and fragile molluscs typifies this environment. Ammonites are characteristic. More robust pelecypods and gastropods are abundant in shallower aspects of the environment. Beds are even and laterally extensive, though considerable vertical fluctuation in grain size and fauna is common. Stratigraphic units are widespread. Sediments of this environment are limited to the Comanche shelf. The Georgetown, Salmon Peak, Del Rio, and Buda Formations and most of the Burt Ranch and Regional Dense Members are products of this environment.

Open Shallow Marine, Moderate to High-Wave Energy

Light-colored, relatively coarse-grained, well-sorted, chiefly bioclastic limestones containing a diverse fauna rich in algae, corals, and a variety of rudists but lacking pelagic Foraminifera are the most common sediment type found in this environment. Individual grains are often abraded and well rounded. Common sedimentary structures include planar and festoon cross-bedding and ripple marks; bodies of this kind of sediment occur as banks, mounds, and pods. Dolomite is rare.

This environment produced the bulk of the Stuart City Reef and upper Devils River Formation and scattered coarse-grained shelly units in the Person Formation (Marine Member) and Segovia Formation (part of the Burt Ranch Member and the "caprinid zone"). In addition, such sediment is found in sporadic layers and patches in the Kainer and Fort Terrett Formations.

Open Shallow Marine, Low-Wave Energy

Generally, light-colored, poorly sorted, muddy limestones rich in miliolid Foraminifera, *Toucasia*, *Monopleura*, oysters and snails, and lacking pelagic Foraminifera predominate in this environment. Mud content and fauna are highly variable. Small-scale ripple marks and cross-bedding are common; muddier outcrops are nodular or homogenized by burrowing organisms. There are scattered low banks and mounds of skeletal material. Dolomitization is not common.

Such sediment forms most of the West Nueces Formation, the Grainstone Member of the Kainer Formation, the lower Fort Terrett Formation, and some of the Segovia Formation.

Restricted Shallow Marine

Generally, light-colored, poorly sorted, commonly burrowed, muddy limestone and dolomite rich in miliolid Foraminifera, oysters, and snails characterize this environment. Fauna is less diverse than above and pelagic elements are absent. Extensive burrowing, wispy structure, intimate interlayering of mud and skeletal sand, small-scale ripples and horizontal current streaks, common flat nodules of chert, and rare calcite pseudomorphs after gypsum are also characteristic. Such sediments tend to be found in the shelf interior on persistent structural highs and in the lee of protective barriers and are common in the Dolomitic Member of the Kainer Formation, the Leached and Cyclic Members of the Person Formation, the lower Fort Terrett Formation, and the middle and upper Segovia.

Tidal Flat

Although it is possible commonly to distinguish between supratidal and intertidal sedimentary rocks, they tend to be intimately intermixed in the Edwards and so have been combined within the tidal flat category. Such rocks generally consist of thin-bedded, pelleted micrite and dolomitized micrite. Faunas are limited to miliolid Foraminifera, cerithid or turritellid snails, and oysters. Common sedimentary structures include stromatolitic or storm crusts, mud cracks, root marks, bird's-eye structures, exposure surface, "rip-up" clasts, thin collapse breccias, pseudomorphs after gypsum, burrows, and various channel features (Pls. 7, A; 8; 17).

Tidal flat sediments accumulated in the Edwards Group over structural highs and in the lee of barriers in the shelf interior. Distinct tidal flat sequences have been recorded in the upper Dolomitic Member of the Kainer Formation, the Collapsed and Cyclic Members of the Person Formation, the Burrowed and Dolomitic Members of the Fort Terrett Formation, and rarely in the middle Segovia Formation.

Cycles in tidal flat sediments are more prominent in the subsurface Edwards and have been

observed in the upper Dolomitic Member of the Kainer Formation and in the Collapsed and Cyclic Members of the Person Formation. A few similar cyclic sequences have been recorded in the Burrowed and Dolomitic Members of the Fort Terrett Formation.

A typical cycle is shown in figure 31; each cycle is 5 to 15 feet thick and as many as seven more or less complete cycles have been recorded from one core (Shell No. 1 Roberts, Karnes County, well index no. 6) through the Cyclic Member.

Each cycle is basically the record of the filling, by carbonate sediment, of a tidal flat channel. The transgressive part of the cycle is thin and mixed with channel-lag material, so that most of the interval represents the regressive part of the cycle. The conceptual sequence of events involved in one complete cycle is outlined below.

Stromatolitic crusts, like the Andros Island dolomite crusts, formed tidal flat surfaces at, and just above, normal high tidel level (Pls. 5, B; 8, B; 17, A). Sediment did not accumulate in great quantity above this level. With the next minor subsidence or sea level rise the tidal flat was submerged, and a basal layer of clasts and shell fragments was produced by wave action, or by later channels that moved back and forth across the new tidal flat, using the old surface as an effective basement. Above these basal clastics pelleted mud and shells were deposited, often intensely burrowed (Pl. 8, C). As channels were cut off they gradually filled up with pelleted wispy mud, succeeded in turn by fine settle-out laminae. Eventually the channels existed only as lakes, blind sloughs, and other depressions in the tidal flat surface. They became evaporite pans (Pl. 17, C) and were filled eventually by stromatolitic dolomite crusts alternating with evaporite layers. Precipitation of gypsum may have produced magnesium-rich water, causing dolomitization of the still-soft channel and shallow marine sediments just beneath the crusts (Pl. 8, D). This is in harmony with recent findings (Illings, Wells, and Taylor, 1965; C. G. St. C. Kendall and G. P. Butler, personal communications, 1967) in the Persian Gulf tidal flats. Subsequent exposure, evaporite solution, and mixing by waves during the succeeding cycle of sedimentation produced the disrupted zone (Pl. 8, A) at the top of the cycle.

Euxinic, Evaporitic Shelf Basin

This environment developed in a starved tectonic basin within the shelf interior that was cut off from normal marine circulation. The result is typically dark, carbonaceous, evenly and finely laminated, muddy limestone beds that alternate with thin beds of gypsum. Collapse breccias represent old gypsum layers. Fossils are rare, but thin-shelled pelecypods and ammonites are found in streaks. Even bedding, carbonaceous content, and fine grain size indicate deposition below wave base, and the presence of scattered ammonites suggests at least some communication with the open ocean.

This environment existed only once, in the subsiding Maverick basin, and produced a unique Fredericksburg-Washita deposit, the McKnight Formation.

Evaporite-Dominated Supratidal Flat

Except for a few preserved remnants of gypsum, layers of collapsed breccia are all that remain of former widespread evaporite layers, and we must turn to these remnant outcrops to interpret the environment of deposition in which they formed.

The distinctly different origins of the McKnight and Kirschberg evaporites should be emphasized, fig. 9). The predominantly layered evaporites of the McKnight were deposited in a tectonically negative, euxinic basin clearly different from the highly saline, interior high tidal flats of the crest of the positive Central Texas Platform in which the nodular Kirschberg evaporites were formed.

Sediments of this class formed in the innermost parts of supratidal flats, analogous to the sebkhas of the Persian Gulf tidal flats (Illing et al., 1965; Kendall and Skipwith, 1969; E. A. Shinn, personal communication, February 1970). Gypsum and anhydrite crystals precipitated, grew, and merged within soft dolomitized muddy sediments to form thick massive layers of admixed nodular gray gypsum and subordinate brown dolomite mud. The dolomite occurs both as a pervasive network between coalesced gypsum nodules and as discontinuous lenses and layers. Associated sediments all reflect very shallow-water or tidal-flat conditions, and faunas are those of the platform interior, with pelagic elements being absent. These evaporite-dominated sediments are localized over structural highs in the interior of the Central Texas Platform. The Kirschberg Evaporite and Allen Ranch Breccia represent, in part, this environment.

Coastal Terrigenous

Shallow marine, intertidal, or terrestrial deposits adjacent to land masses are included in this class.

Sediments are typically red, brown, or yellowish, calcareous, sandy, silty or clayey, and poorly sorted, with sparse molluscan faunas and without pelagic elements. Bedding is massive and erratic, and thickness of sediment bodies varies. Sediments of this class occur in the lower Fort Terrett Formation adjacent to the Llano uplift.

FORMATION OF CLINOFORMS

The Fredericksburg time-stratigraphic unit maintains a fairly constant thickness over the Central Texas Platform but thickens slightly into negative areas (fig. 14). But as the Lower Washita unit passes into either basin, it thins so that the upper surface of the unit is a clinoform. How is it that clinoforms develop during deposition of one carbonate cycle but not its immediate precursor?

Obviously, a clinoform will form where accumulation cannot keep pace with subsidence, the break-in-slope representing the point at which they are just equal (if all the sediments at the break-in-slope represent very shallow-water accumulation). Accumulation rate is a function of sediment production and sediment dispersion. But we are dealing with two units contiguous in time and space that were deposited under the influence of the same regional elements. Moreover, rock types and dominant faunal elements of the two units are so similar that carbonate producers must have been similar also. Accordingly, it seems reasonable that differences in carbonate production and dispersive currents between the two units were not significant. By process of elimination, then, greater subsidence rate during the early Washita appears to have been the chief factor responsible for construction of clinoforms (Rose, 1968b).

It is generally accepted that the gulfward side of the Maverick basin was subsiding more rapidly than the northern side. If subsidence rate does indeed control clinoform construction, we should expect to find steeper clinoform slopes in more rapidly subsiding areas and gentle slopes in slowly subsiding areas. Comparison of sections E-E′ and F-F′ (Pl. 3) shows that basinward thinning of the Pryor Member is much more gradual on the north side, where subsidence was slower, and confirms that expectation.

Finally, we may try to estimate subsidence rates for the two units. At the break-in-slope, accumulation rate and subsidence rate are equal, and both stratigraphic units are of approximately the same thickness—450 feet. But Fredericksburg time appears to have lasted two to four times as long as early Washita time:

(1) In the subsurface of the North Texas—Tyler basin, where the Fredericksburg and Lower Washita are in rather similar, low-energy, normal marine facies and accumulation appears to have been continuous, the Fredericksburg is about four times as thick as the Lower Washita.

(2) In a personal communication (1968), Dr. K. P. Young has suggested that on the basis of ammonite evolution and zonal character, Fredericksburg time lasted perhaps twice as long as the early Washita.

Accordingly, early Washita subsidence was two to four times faster than Fredericksburg subsidence, which independently supports the theoretical findings.

DIAGENESIS OF THE EDWARDS GROUP

Diagenesis is the least understood of the major processes that influence carbonate rocks and to ground water or petroleum geologists the most significant, for it is the most important agent involved in the creation and destruction of porosity. Diagenesis is used here to mean those physical and chemical changes (short of thermal metamorphism) that sediments undergo during and after accumulation and burial, including those that take place after consolidation. In carbonate rocks these changes occur in a wide variety of situations: while the original depositional environment still prevails, during elevation, erosion, and exposure, after shallow burial, and after thousands of feet of burial.

From the history of the Gulf Coast geosyncline we know that once the Edwards along the Fashing-Person trend was buried beneath Upper Washita marine sediments, subsidence was thereafter continuous during accumulation of roughly 3,000 feet of Upper Cretaceous and Paleocene argillaceous marine sediment and about 7,000 feet of Eocene and Oligocene marginal marine and alluvial terrigenous sediment. Such a history eliminates the possibility of alteration by weathering or fresh ground water during repeated cycles or extended periods of uplift. Therefore, diagenetic changes in deep Edwards rocks must be related to (1) processes that were active during or very soon after deposition; (2) processes that were related to the unconformity at the top of the Edwards; (3) processes

that acted while the Edwards was deeply buried, related to tectonics and/or circulation of deep subsurface fluids.

Unfortunately, we cannot be quite so sure about the Edwards of the shallower subsurface area, for example, along the Luling fault zone. At the present time fresh water (less than 1,000 ppm dissolved solids) does not extend downdip beyond about the zero subsurface contour (Arnow, 1957, p. 4; 1963, p. 30; Shafer, 1966, p. 29). It is conceivable, but not probable, however, that fresh water might have penetrated farther southeast, even as far as the Luling trend, during the late Tertiary or Pleistocene.

The Edwards of the Edwards Plateau was not covered and buried immediately but was exposed repeatedly to weathering and ground-water alteration until the plateau region finally foundered late in Washita time. The carbonate mass was probably laid bare and weathered again during the later Tertiary and Quaternary, and this different later history is the best single explanation for the common occurrence of surface and subsurface Edwards rocks that have strikingly similar depositional textures and sedimentary structures but equally dissimilar diagenetic fabrics.

COLLAPSE STRUCTURES

In the discussion of Edwards tidal flat cycles (p. 53) it was pointed out that evaporite layers, stromatolites, and collapse breccias are an integral part of the cycle.

These subsurface collapse breccias were almost certainly caused by early dissolution of thin evaporite layers and lenses (Pl. 17, B) that precipitated in the final stages of the tidal flat cycle. Two lines of evidence indicate that the breccias did not form after being deeply buried. First, many of the collapse structures are almost entirely mud-filled; preferential and thorough emplacement of mud-sized sediment *between* angular clasts at great depth seems improbable to say the least. Second, if the collapses occurred at depth, the breccia zones would not be thin (1 to 3 feet) and would not alternate with apparently undisturbed beds.

If removal of gypsum and consequent collapse occurred at or near the surface, it seems probable that meteoric water must have been the chief dissolving agent. In the Karnes trough intertidal and supratidal strata of the Cyclic and Collapsed Members frequently contain anhydrite (example, Tenneco No. 1 Harper, Karnes County, well index no. 22, Pl. 17, C, whereas equivalent beds on the upthrown blocks are collapsed and do not contain anhydrite. These upthrown blocks almost certainly were more frequently exposed. Figure 11, A, shows such an example.

Two types of subsurface collapse breccias have been identified. *Spar-filled* collapse structures (Pl. 17, B) contain a variety of angular limestone and dolomite lithoclasts. They are believed to have originated a few feet or tens of feet beneath the surface when gypsum beds dissolved, creating a subjacent void into which overlying rocks collapsed. Later the angular cavities were filled with sparry calcite cement. *Mud-filled collapse structures* (Pl. 17, D) also contain a variety of clasts, but many fragments are rounded. These breccias probably formed by subaerial dissolution of gypsum layers at, or just beneath, the tidal flat surface. The resulting rubble may have been subsequently altered by weathering and tidal currents into "disrupted zones" (Pl. 8, A), channel lag deposits, and flat-pebble conglomerates. In the core from Shell No. 1 Dugie, Karnes County (not described), a collapse breccia between 10,724 to 10,728 feet is mud-filled in the upper 3 feet and grades downward into a spar-filled breccia in the lower foot.

Most of the collapse breccias occur as thin multiple zones with undisturbed bedding above and below. Most zones are dolomitized and have good, locally cavernous, porosity and excellent permeability because they have been leached of calcite cement. They are most abundant near the San Marcos Platform.

Although it seems probable that Cretaceous meteoric water was the chief dissolving agent, some of the gypsum may have been dissolved and removed by sea water of normal salinity flooding the tidal flat surface.

At the outcrop, collapse breccia is widespread but confined chiefly to two stratigraphic levels, Kirschberg and Allen Ranch. Most breccias are of three intergrading types:

I. Thick, laterally persistent breccia composed of limestone, dolomite, and chert fragments, highly disrupted and chaotic, commonly dolomitized and/or recrystallized, and rather well cemented by crystalline calcite or dolomite.

II. Breccias related to type I but with most clasts dissolved leaving a network of crystalline limestone. These are called "chicken-wire" or "network" breccias.

III. More erratic masses of breccia composed mostly of porcellaneous to lithographic micrite, sometimes highly disrupted but often only incipiently brecciated, commonly poorly cemented and porous, and unaltered by dolomitization or

recrystallization.

The first variety is typical of the Allen Ranch and middle and lower Kirschberg; the second of the middle and lower Kirschberg; and the third of the uppermost Kirschberg. Type I may be closely related to actual gypsum removal, type II to severe secondary alteration of type I, and type III represents "second-stage brecciation" related perhaps to settling and adjustment of the brittle beds in the thin sequence above the altered former gypsum interval. Fakundus and Moore (1970) pointed out that the Kirschberg sequence of a lower, severely altered residual unit overlain by less altered limestone breccias is characteristic of many solution breccias. A few thin brecciated or disrupted zones analogous to the mud-filled subsurface breccias have been observed, but sedimentary structures in these zones are usually obliterated by ground-water alteration. In fact, most thin, severely altered aquifers may represent thin, mud-filled breccias.

Most collapse breccias in the surface Edwards differ from their subsurface counterparts in at least four ways:

(1) Sedimentary structures of porous brecciated or disrupted zones that are analogous to the subsurface tidal flat breccias are ordinarily obliterated by ground-water alteration.
(2) Surface breccias consist of crystalline limestone as well as dolomite.
(3) They are 5 to 15 feet thick in most places and occur as only one or two zones, not as thin multiple layers.
(4) They do not commonly contain fragments of stromatolitic hard crusts.

The different post-depositional history of outcropping Edwards rocks accounts for the first two items; item (3) can probably be ascribed to the original presence of thicker concentrations of gypsum because of higher salinities in the platform interior, and item (4) is compatible with the previous suggestion (p. 53) that the Kirschberg and Allen Ranch were formed on high supratidal, sebkha-like environments. E. A. Shinn (personal communication, February 1970) pointed out that diagnostic intertidal and supratidal structures are much less common in the more evaporitic and disrupted sediments of the Persian Gulf tidal flats than on the more temperate Andros Island tidal flats.

Superficially, the presence of more than 30 feet of Kirschberg gypsum north of Fredericksburg, and its absence elsewhere, might suggest that the solution and removal of the gypsum is relatively recent, the remaining small amounts being only remnants surviving a widespread solution, perhaps during more humid Pleistocene time. But in the Gillespie County area ground water presently issuing from the base of the Edwards is essentially free of sulfate (Barnes, 1944, p. 40), so no significant solution can be going on presently. Barnes has reported (1944, p. 45) that the gypsum is preserved in areas that are structurally high and suggested that the areal flow of ground water, following the sloping base of the Edwards, has by-passed and isolated the gypsum area. The writer has no more satisfactory explanation.

Penecontemporaneous gypsum removal was suggested for the Kirschberg by Fisher and Rodda (1967, p. 57) because strata overlying 5- to 10-foot breccia units were undisturbed. Outcrops in northeastern Edwards County (locality 38) and west-central Kerr County (locality 50) provide additional evidence on time of gypsum removal. At locality 38 micrite breccia is well developed near the top of the Kirschberg (Pl. 19, D). Overlying upper Kirschberg limestone beds dip erratically, in response to the collapse beneath. Some of these dipping beds are truncated by uppermost Kirschberg limestone beds, and the overlying Burt Ranch Member is flat. This indicates that at least some gypsum was removed and collapse occurred during deposition of the upper Kirschberg and, further, that the breccia must have been lithified rock during Kirschberg deposition.

At locality 50 dolomite and crystalline limestone beds about 15 feet below the top of the Kirschberg are truncated by higher beds of porcellaneous micrite, again indicating gypsum removal and lithification during deposition of the Kirschberg (Pl. 18, A). Yet not all the gypsum removal was penecontemporaneous; erratic dips in the middle Burt Ranch are common in the northern part of the area and indicate that some gypsum was removed after deposition of at least 30 to 40 feet of Burt Ranch. Of course, such collapse may even be modern.

The normal marine waters from which the Burt Ranch Member was deposited could well have dissolved much of the Kirschberg gypsum, which at that time lay less than 20 feet below the depositional substrate. Most gypsum was removed from the subsurface Edwards during and shortly after deposition, and the Kirschberg horizon is present in the subsurface as breccia, not as gypsum, which probably rules out removal during the Pleistocene or Recent because of the subsidence history of the Coastal Plain. Accordingly, we must interpret, as a regional generalization, the penecontemporaneous removal of gypsum from the surface Edwards Group as well.

DOLOMITE

Introduction

For a review of recent developments in geochemistry and modern sedimentology that bear on the origin of Edwards dolomite, the reader is referred to the summary by Fisher and Rodda (1967).

On a grand scale, Edwards dolomite seems to have an affinity for rocks formed in very shallow water. Regionally it is concentrated in areas that were tectonically positive, hence tended to remain shallow, such as the axis of the Central Texas Platform and the Medina axis (figs. 14, 15, 21, 23). It is characteristic of areas in which hypersaline waters persisted (Moore, 1967). Sedimentary structures and regional mapping indicate that most dolomitized Edwards rocks accumulated in the tidal flat or restricted shallow marine environments; field and petrographic relations (Fisher and Rodda, 1967, p. 65) suggest that much dolomitization occurred as metasomatic replacement of soft aragonitic or calcitic sediment, but that some open shallow marine deposits, however, seem clearly to have been dolomitized long after they were lithified.

Classification and Origins

In order to review the distribution and origins of Edwards dolomites, the classification proposed by Fisher and Rodda (1967, 1969) must be modified because it does not satisfactorily account for the thick beds of massive, fine-crystalline dolomitized micrite and biomicrite that constitute the most abundant type of dolomite in the Edwards. Accordingly, four classes of Edwards dolomite are recognized: stratal, massive-bioclastic, massive-muddy, fissure-filling.

STRATAL DOLOMITE

This class includes dolomites thought to have formed by early metasomatic replacement of soft aragonitic, supratidal sediments through saturation of magnesium-rich ground waters concentrated by evaporation. Thin bedding, fine-crystal size, and sedimentary structures indicative of the tidal flat environment are characteristic of this class.

Thin-bedded dolomitic sequences associated with hard crusts, root marks, desiccation structures, thin collapse breccias, and other supratidal structures like similar features characteristic of Andros Island tidal flats are common in the upper Dolomitic Member of the Kainer Formation, Collapsed and Cyclic Members of the Person Formation, and Burrowed and Dolomitic Members of the Fort Terrett Formation. Intimate interbedding of limestone and dolomite is common (Pl. 18, B and C). This class seems to be more abundant in the subsurface than in outcropping Edwards rocks, but this may be because severe surface alteration obliterates these structures in porous dolomite, or because such structures might have been destroyed in the more evaporitic, sebkha-like tidal flats of the interior of the Central Texas Platform. Moore (1967, p. 68) reported common tidal flat features in the Fort Terrett to the north of the study area. Stratal dolomite is most abundant near the Central Texas Platform, but even there, it is volumetrically less significant than the massive-muddy type.

MASSIVE-BIOCLASTIC DOLOMITE

This is the class designated by Fisher and Rodda (1967) as "massive dolomite." Following the reflux concept of Adams and Rhodes (1960), Fisher and Rodda suggested that coarsely bioclastic marine beds were dolomitized by magnesium-saturated ground waters flowing downward and outward from evaporite lagoons. Replacement took place after the host rock had been lithified. Characteristically this type of dolomite is medium crystalline and porous and occurs as thick intervals of replaced biosparite or intrasparite adjacent to evaporite units.

As Fisher and Rodda indicated, such dolomite is much more common on the northern side of the Central Texas Platform than on the axis or to the south. Scattered dolomitized bioclastic intervals or rudist banks are, however, found in the lower Dolomitic Member of the Kainer Formation, the Burrowed and Dolomitic Members of the Fort Terrett Formation, and the upper Segovia Formation.

MASSIVE-MUDDY DOLOMITE

The most common habit of Edwards dolomite on the axis and southwest flank of the Central Texas Platform is homogeneous, thick-bedded to massive, ordinarily burrowed, fine-crystalline, dolomitized micrite and biomicrite that occur in intervals 4 feet to 60 feet thick. Such dolomite cannot be classed "stratal" because it does not commonly display supratidal or even intertidal structures, and because it occurs in beds much thicker than those described by Fisher and Rodda. Neither can it be included in the "massive-bioclastic" category, because of its fine grain and crystal size (Pl. 5, A), because it was

probably dolomitized while still soft, and because large-scale reflux does not provide a convincing explanation for the origin of this dolomite, for reasons outlined below.

(1) The reflux thesis requires the very steady migration, through fine-grained, relatively impermeable sediments, of hypersaline water only slightly heavier than the marine interstitial water which it displaces. For these Edwards dolomites it requires lateral migration over tens of miles but vertical migration of ordinarily less than 60 feet, because regional structural and stratigraphic relations preclude topographic relief, thus hydraulic head, of greater than about 60 feet in this area. Moreover, boundaries between this type of dolomite and subjacent muddy nondolomitic rock are almost always coincident with bed boundaries, indicating that no dolomitizing fluids could have crossed from the overlying muds into the underlying ones.

Hsu (1966) suggested that reflux powered by differences in water densities was insufficient to induce extensive dolomitization. A quantitative analysis (Appendix G) shows that, using figures most favorable to the reflux hypothesis and assuming 100 percent efficiency, the amount of magnesium capable of being flushed through the sediment in the available time is still smaller by more than two orders of magnitude than the amount of magnesium emplaced in the sediment.

(2) Rogers' statement (1967, p. 58) that the Edwards carbonate complex on the San Marcos Platform seems to fit the Permian reflux model of Adams and Rhodes overlooks the fact that the Stuart City Reef contains no dolomite, whereas the Permian shelf-edge carbonates are extensively dolomitized. Furthermore, the increase in dolomite percentage toward the interior of the Central Texas Platform, cited by Rogers as evidence for reflux, can be explained equally well by the increase of hypersaline conditions toward the interior of the platform.

(3) It is probable that the Kirschberg Evaporite was formed in highly saline, sebkha-like tidal flats, not in a shallow evaporite basin. Moreover, Hsu and Siegenthaler (1969) have shown experimentally that "evaporative pumping" on arid tidal flats is capable of passing enough concentrated lagoonal water through fine sediment to provide ample Mg^{2+} to dolomitize the calcareous muds.

The presence of this type of dolomite at the outcrop as well as in the subsurface makes it improbable that it formed by late diagenesis deep in the subsurface, or by preferential dolomitization connected with ground-water flow more recent than Early Cretaceous. Therefore, the origin of this dolomite, even though imperfectly understood, is probably related to the primary depositional environment or to diagenetic processes so early that they were still a part of the depositional environment—a conclusion compatible with the evaporative pumping mechanism of Hsu and Siegenthaler (1969).

The limited molluscan fauna and extensive burrowing would seem to preclude permanent hypersaline conditions but suggest rather that the original sediment was formed in the restricted shallow marine or intertidal realms and dolomitized subsequently. In a prograding tidal flat complex, supratidal muds would be expected to build out over intertidal and shallow marine sediments, which might then become dolomitized by "evaporative pumping."

The homogeneous character of these "massive-muddy" dolomites and the general paucity of definitive supratidal structures suggest an analog with similar massive, featureless dolomitized intertidal and supratidal deposits of the Persian Gulf (E. A. Shinn, personal communication, February 1970).

Whatever the process, it seems clear that origin neither in Andros-type supratidal zones nor by large-scale seepage refluxion from an evaporitic shelf basin will explain adequately these massive-muddy dolomitic units so common in the Dolomitic Member of the Kainer Formation, Leached Member of the Person Formation, Burrowed and Dolomitic Members of the Fort Terrett Formation, and the middle part of the Segovia Formation.

FISSURE-FILLING DOLOMITE

This class of dolomite is volumetrically the smallest of the four classes of Edwards dolomites. Medium- to coarse-crystalline dolomite (.0625 to 1.0 mm) may form rather late, commonly in secondary voids such as fault zones, fractures, evaporite solution fissures and bedding plane fissures, perhaps through redistribution of previously existing dolomite by vadose ground water or by circulation of deep subsurface brines. In addition, it is found in dolomitized intervals of the shallower subsurface on the San Marcos Platform, perhaps reflecting secondary recrystallization or replacement. But it is also found deep in the subsurface in the lower part of the Kainer Formation, associated with anhydrite which also occurs as fracture

fillings, suggesting a relatively late emplacement of anhydrite (and perhaps dolomite also) by fluids circulating in fractures.

Dolomite Distribution, Porosity and Faulting

Regardless of specific mode of formation one fact is very clear: The original emplacement of nearly all Edwards dolomite is related to shallow-water deposition on the Central Texas Platform (figs. 14, 15), not to faulting (Rogers, 1967, p. 58). In the subsurface, porosity in dolomitic rocks is related to removal of aragonite or calcite shell fillings and interstitial cement. Because dolomitic units have apparently undergone more leaching on upthrown structural blocks than in structurally low areas that were only rarely exposed, the upthrown blocks are less calcitic than the downthrown blocks. So faulting affects dolomite distribution only indirectly, by causing dolomitic rocks in upthrown blocks to contain more or less calcite.

Dolomite is a better reservoir rock than limestone in the subsurface Edwards not because it is more porous, but because it is more permeable. Moreover, pore spaces in dolomite tend to be smaller than in limestone, but the fine-crystalline dolomite matrix, even when only slightly leached of its interstitial calcite, produces a network of connected fine pores.

CRYSTALLINE LIMESTONE

Crystalline Limestone and Collapse Zones

Vaguely laminated, medium- to coarse-crystalline limestone intervals are common in the altered zones of the Kirschberg Evaporite (Pl. 19, A). Whether the laminations represent relict bedding or the sequential emplacement of secondary limestone layers during gradual removal of gypsum is not known. The fact that crystalline limestone, not collapse breccia, is the chief rock type that occupies the old gypsum interval, plus the fact that the Kirschberg appears to be about as thick where the gypsum is still present as where it is absent, suggest that gypsum was removed gradually and crystalline matrix added simultaneously. Stanton (1966) has suggested a similar process of formation for Devonian collapse breccias, in which coarse-crystalline dolomite rhombs liberated in the solution process form the matrix that surrounds larger clasts.

Commonly, matrix material of both Kirschberg and Allen Ranch breccias consists of a mosaic of fine-crystalline calcite. Some clasts are also finely recrystallized but many consist of medium- or coarse-crystalline rhombic calcite and are more or less friable and porous. Finally, many clasts appear to grade laterally into the matrix, suggesting a late pervasive recrystallization of the whole rock (Pl. 14, B).

Both breccia horizons seem to be present at the surface as well as in the subsurface, but the subsurface breccias are dolomitized. James Quinlan (personal communication, July 1968) reported that some massive crystalline limestone in the Kirschberg of the type area is in fact dedolomite, that is, calcite pseudomorphs after dolomite, and this was confirmed by Moore et al. (1968). It is probable that much of the crystalline limestone in outcropping Edwards rocks throughout the Edwards Plateau will prove also to be dedolomite.

DeGroot (1967) showed experimentally that conditions necessary for dedolomitization are a high Ca/Mg ratio in the dedolomitizing solution, high rate of water flow, partial pressure of CO_2 less than 0.5 atmospheres, and temperature less than 50°C, and suggested that dedolomitization is probably a near-surface phenomenon. Evamy (1967, after Tatarskiy, 1949) indicated that surface water enriched in calcium sulfate by solution of evaporites is responsible for dedolomitization of outcropping beds. Accordingly, it is interpreted that dedolomite in Edwards collapse breccias was promoted by downward percolation of $CaSO_4$-saturated ground waters involved with solution and removal of the gypsum. The fact that surface zones of crystalline limestone beneath breccia commonly consist of dolomite in the subsurface is supporting evidence of the activity of ground water in the dedolomitization process.

Microspar

Rusty, recrystallized limestone composed of a fine mosaic of crystalline calcite, called "microspar" in the core descriptions, is characteristic of the Edwards in upthrown fault blocks southeast of the Karnes trough. Average size of the calcite crystals is 20 to 50 microns, larger than Folk's (1959, p. 32) described microspar (5 to 15 microns). Some crystals have distinct rhombic forms. This material is not present in the Person Formation in the Karnes trough, however, leading to the supposition that the recrystallization was related to early exposure or ground-water alteration of the more frequently exposed upthrown blocks, perhaps by dedolomitization. The microspar commonly replaces what was

apparently micrite matrix and also preferentially alters mud pellets and Foraminifera, particularly *Dictyoconus* and miliolids. It is very common in coated intraclasts in the Kainer Formation but is uncommon in sparry limestones, particularly as matrix replacement. It is present in small amounts in shallower cores from the San Marcos Platform.

In the Edwards Plateau, limestone beds that are deeply weathered or interbedded with dolomite are commonly found to be recrystallized (*see* Paint Creek, Orr Ranch, and Vanderpool measured sections). Crystal size varies from 10 to 50 microns, and micritic rocks seem to be most susceptible to recrystallization. Lateral interfingering of crystalline limestone and dolomite is particularly striking in the Vanderpool section (Pl. 19, B). The interfingering is in part depositional and not entirely diagenetic, because thin dolomite beds can be seen to pinch out against the limestone tongues.

PULVERULITE

Very soft, finely friable, porous pulverulent limestone and dolomite can best be studied in highway road cuts. This material is so soft that field mice frequently establish elaborate burrow systems in the soft zones. The pulverulite apparently forms as a surface-weathering process, for in most places the soft material grades back into hard rock within 2 feet from the face of the road cut and pulverulite is most common in shallow road cuts. Furthermore, beds of marl and soft dolomite commonly pass into pulverulite near the ends of road cuts. Finally, little pulverulite is present in new road cuts along Interstate Highway 10 in eastern Kimble County, whereas it is common in nearby old road cuts of U. S. Highway 290, made about 25 years ago. Microscopically, pulverulite is seen to contain abundant football-shaped, fine grains that suggest rounded rhombs.

Two types of rock are most susceptible to "pulverulitization":

(1) Massive homogeneous dolomite alters to medium-grained, smooth, powdery material consisting of uncemented, fine-crystalline, well-sorted dolomite rhombs.
(2) Marly limestone alters to white, caliche-like powder consisting of fine-crystalline, well-sorted calcite grains and liberated clay.

One can readily explain pulverulent dolomite as the product of preferential solution of calcite cement from calcitic dolomite; perhaps nondolomitic pulverulent limestone is produced by preferential solution of finer crystalline calcite, leaving coarser crystals and clay.

Vertical "pipes" filled with pulverulite are common along old U. S. Highway 290 east of Segovia and were discussed by Blank and Tynes (1965), who described the pulverulite as caliche. Calichification is an additive process whereby calcium carbonate accumulates beneath a soil horizon. These pulverulent dolomite pipes clearly represent a process of removal, not addition, whereby material (calcite cement) has been dissolved leaving only the loose dolomite admixture. That the process of pipe formation is one of removal is also indicated by the sag of beds that span pipes (Pl. 19, C). Apparently pipe formation is a feed-back process in which water gathers locally in low areas and slowly dissolves some cement before percolating downward. This produces more porous rock that can hold more water which in time causes a slight in situ sag. This in turn enlarges the depression, allowing more water to gather, etc. Yet generally no cave is formed, only a vertical pillar-like mass of soft pulverulite of unknown depth.

On the other hand, swelling of bedded pulverulite and calichified marl near ends of road cuts indicates that addition of material does occur, as shown by Blank and Tynes. Calichification and "pulverulitization" are different but perhaps not necessarily independent processes.

POROSITY AND PERMEABILITY

Subsurface

Examination and comparison of cores and cuttings from the Fashing-Person trend indicate that porosity is highest in the upthrown blocks along the main Person Field fault zone and lowest in the Karnes trough. Apparently, carbonate sediments deposited on persistent structural topographic highs were exposed and leached more frequently throughout deposition of the Person Member, whereas sediments that accumulated in persistent structural lows were infrequently leached. This is in harmony with environmental interpretations of the Person Member and may explain the occurrence of porosity in upthrown blocks of Edwards and lack of it in adjacent downthrown blocks.

Northwest of the Karnes and Atascosa troughs, toward the axis of the San Marcos Platform, Edwards porosity appears to increase. Certainly, the overall porosity of the Mercer and Jolley cores exceeds that of the Fashing-Person cores. Deep, late subsurface cementation of the Fashing-Person rocks might account for such porosity patterns. If spar-

filled fragmental carbonate rocks were the dominant constituent of the Edwards, such an hypothesis might be reasonable, but the Edwards is chiefly a micrite formation—and micrite is generally thought to be a *primary* constituent. Nor does compaction seem a reasonable explanation, for deep Edwards fossils and fragile sedimentary structures are almost never distorted or deformed. Furthermore, it is one of the accepted principles of carbonate stratigraphy that carbonate sediments lithify quickly after exposure, and certainly the tidal flat structures of the Edwards suggest frequent exposure. Therefore, significant reduction of porosity by compaction seems to be improbable.

A more likely alternative is involved with the disconformity at the top of the Edwards. Although erosion occurred over most of the San Marcos Platform, the most deeply eroded part coincides with the axis. Perhaps in this area ground-water leaching reached deeper and lasted longer than it did on either side. A second plausible explanation has to do with subsidence rates. Judging from isopachous maps of the Person Formation and overlying formations (figs. 14-18) subsidence was more rapid to the southeast than on the northwest part of the platform, where porosities are generally highest. To the northwest, then, individual sequences of tidal flat rocks would have been exposed and leached longer and more often than similar sequences to the southeast.

The Selma core contains abundant caverns developed in the collapse breccia and dolomite of the upper Dolomitic Member of the Kainer Formation that are filled with fragmental debris and red clay. It seems probable that these caverns are of Pleistocene or Recent origin. The well was drilled in the fresh-water zone of the Balcones fault trend. Although caverns and vugs are encountered in the shallow Edwards of Caldwell and Guadalupe counties, they are generally not as extensive as are those of the Selma core, nor are they filled with red, *terra-rossa*-like material.

Surface

There is great contrast between the porosity and permeability patterns of the surface and subsurface Edwards, and the long history of subaerial exposure and ground-water flow through the surface Edwards accounts for most if not all of the differences.

The Edwards of the Fashing-Person trend is more porous toward the top, and the pore network generally consists of fine intercrystalline or intergranular porosity, with fairly good permeability in leached-porous dolomite. Vugs are rare, and although the formation is jointed and fractured, the cracks are not enlarged.

On the other hand the outcropping Edwards is more porous toward the bottom. Effective porosity consists of caverns, vugs, enlarged fractures and bedding seams, and leached burrows. The result is extremely high permeability, but as a whole, fairly low matrix porosity, except in leached dolomites. It was previously mentioned that the lower part of the Fort Terrett (Basal Nodular and Burrowed Members) is a permanent fresh-water aquifer; it is probable that subsurface solution is presently going on in the base of the Fort Terrett, where porosity is generally highest. As further evidence of this, at several fresh-water springs (for example, 700 Springs at the headwaters of South Llano River) ground water emerges in a slightly undersaturated state, for long, deep, winding, smooth-walled slots have been cut into solid rock by emerging springs (Pl. 18, D). This is unusual, for Central Texas limestone springs more commonly *deposit* calcium carbonate around the point of issue, as travertine. It seems probable, therefore, that in the zone of permanent water saturation at the base of the Edwards, porosity is being created at the present time by dissolution of the limestone.

SYNTHESIS

INFLUENCE OF THE CENTRAL TEXAS PLATFORM

For most stratigraphic units in the Gulf Coast region, depositional strike tends to be roughly parallel to the basin margins. Accordingly, the trend of the Stuart City Reef, as defined during the 1950s, was generally accepted by subsurface geologists as just another example of this characteristic, and the belt of tidal flats along the Fashing-Person trend seemed also to fit the overall pattern. So the Stuart City Reef was thought of as the dominant element influencing deposition on the Comanche shelf; by this concept, stratigraphic cross sections *normal* to the Stuart City would have been expected to show a lateral facies sequence that reflected increasing restriction and evaporation toward the interior of the shelf. Cross sections so oriented do show, grossly, such facies progressions. But, in this context, it is instructive to examine the facies progressions of the Fredericksburg and Washita from the Maverick basin, across the San Marcos Platform into the North Texas—Tyler basin (fig. 32), a subsurface line of section that is not normal but *parallel* to the Stuart City Reef and thus might have been expected to reflect, generally, depositional strike because of its orientation. The Fredericksburg is shown as a very shallow-water, highly restricted facies complex centered over the San Marcos Platform (fig. 32, A). Euxinic and evaporitic deposits (McKnight) occupy a closed basin on the west, and shallow marine rocks (West Nueces and Devils River) occur along the basin margins. Over the broad axis of the positive San Marcos Platform shallow marine carbonates and dolomitic tidal flat deposits are present (Kainer). Between the tidal flat deposits of the platform and open shelf marine beds of the North Texas—Tyler basin (Walnut and Comanche Peak) lie shallow marine calcarenite banks and bioclastic mounds, such as the Whitestone and Moffat lentils.

The Lower Washita (fig. 32, B) appears as an almost classic carbonate facies progression, from open-shelf micrite (Pryor), to "reef" (Devils River), to shallow marine "back-reef" bioclastic limestone (Person), to tidal flat dolomite and limestone (Person) over the axis of the San Marcos Platform, back to particulate shallow marine limestone (Person), to open-shelf, full marine micrite again (Duck Creek and Kiamichi). Truncation of Person beds is shown to be the result of uplift of the axis in post-early Washita time.

The depositional environment of the Upper Washita is totally open shelf. Upper Washita beds fill in and then blanket Lower Washita topography (fig. 32, C); accordingly, an inverse thickness relationship exists between them.

Clearly, figure 32 indicates that the San Marcos Platform influenced facies tracts on the Comanche shelf more than did the Stuart City Reef.

In figure 33 comparison of surface (B) and subsurface (C) cross sections indicates their similarity, suggesting that the Central Texas Platform was, in fact, the dominant element controlling environmental belts throughout the entire shelf interior. Previous work by Fisher and Rodda (1967, 1969) and Moore (1967) on Fredericksburg rocks has similar implications.

Figure 33, A-C, portrays the Edwards as a very wide belt of shallow-water sediments deposited behind marginal banks, the lateral succession of facies reflecting increasing restriction toward the axis of the Central Texas Platform and, to some extent, in the lee of the marginal banks. This is, of course, a classic depositional pattern for carbonate complexes.

DEPOSITIONAL HISTORY

Introduction

Meaningful paleogeographic interpretations generally presuppose that a reliable, documented stratigraphic framework exists, against which arrays of facies may be seen to shift in time and space. Such internal frameworks for the Fredericksburg and Washita of north-central Texas, and the Maverick basin and western Edwards Plateau of Southwest Texas, had already been provided by previous workers, and the purpose of the preceding section on stratigraphy was to delineate such a framework for Fredericksburg and Washita rocks of the San Marcos Platform and eastern Edwards Plateau. Figure 34 shows the temporal relations of the several dozen rock bodies that make up the Fredericksburg and Washita of Texas, and figure 33 contains three regional stratigraphic cross sections that indicate physical relations of stratigraphic units, their thicknesses and depositional environments. It should be emphasized that much of the concluding synthesis is built into these illustrations.

The depositional surface during Fredericksburg and Washita time must have been exceedingly flat; even today the Edwards Group has been disturbed only slightly in the Edwards Plateau, where its

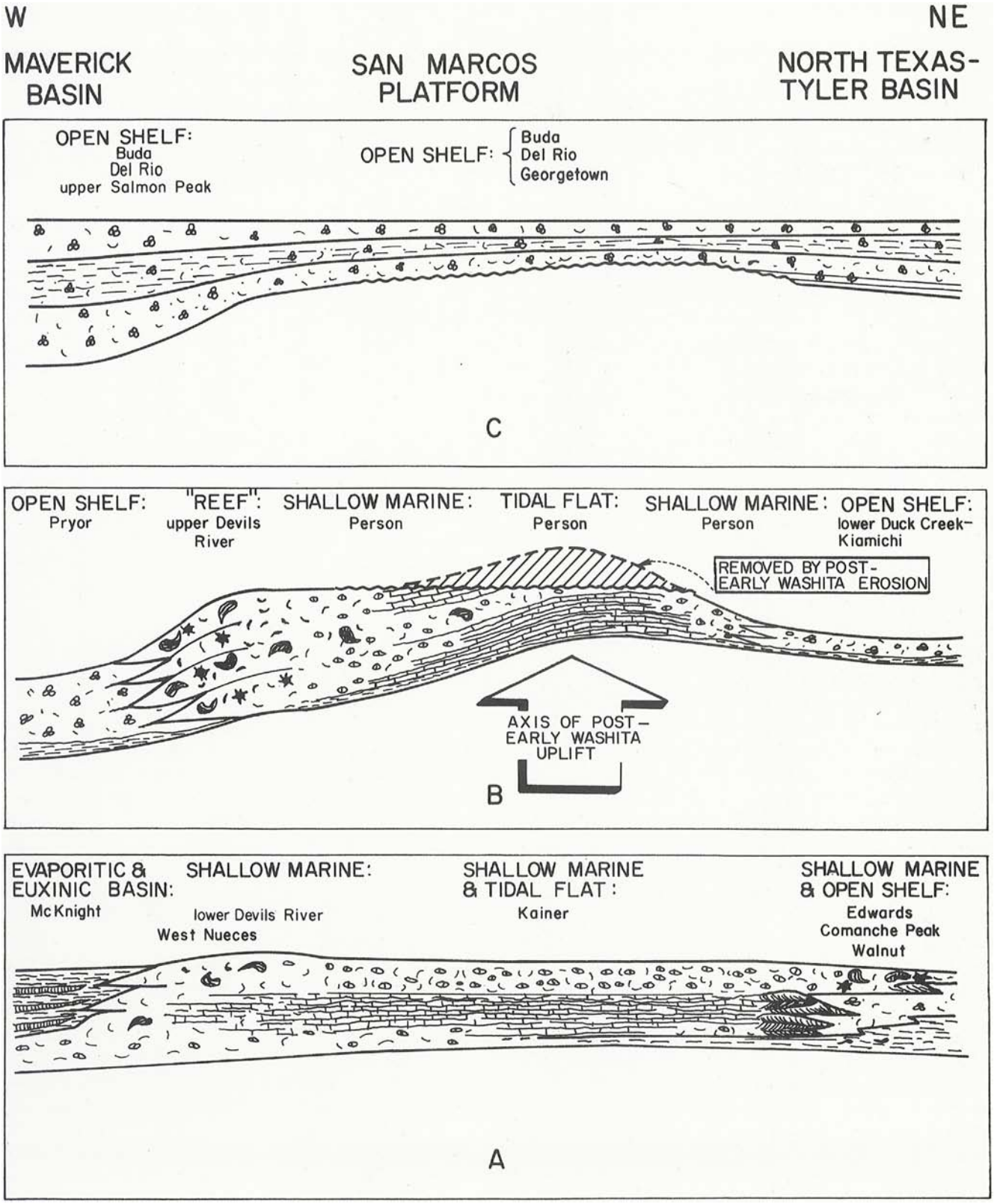


FIG. 32. Generalized Fredericksburg and Washita facies progressions across the subsurface San Marcos Platform, Central Texas. A, Fredericksburg Division. B, Lower Washita time-stratigraphic unit. C, Upper Washita time-stratigraphic unit.

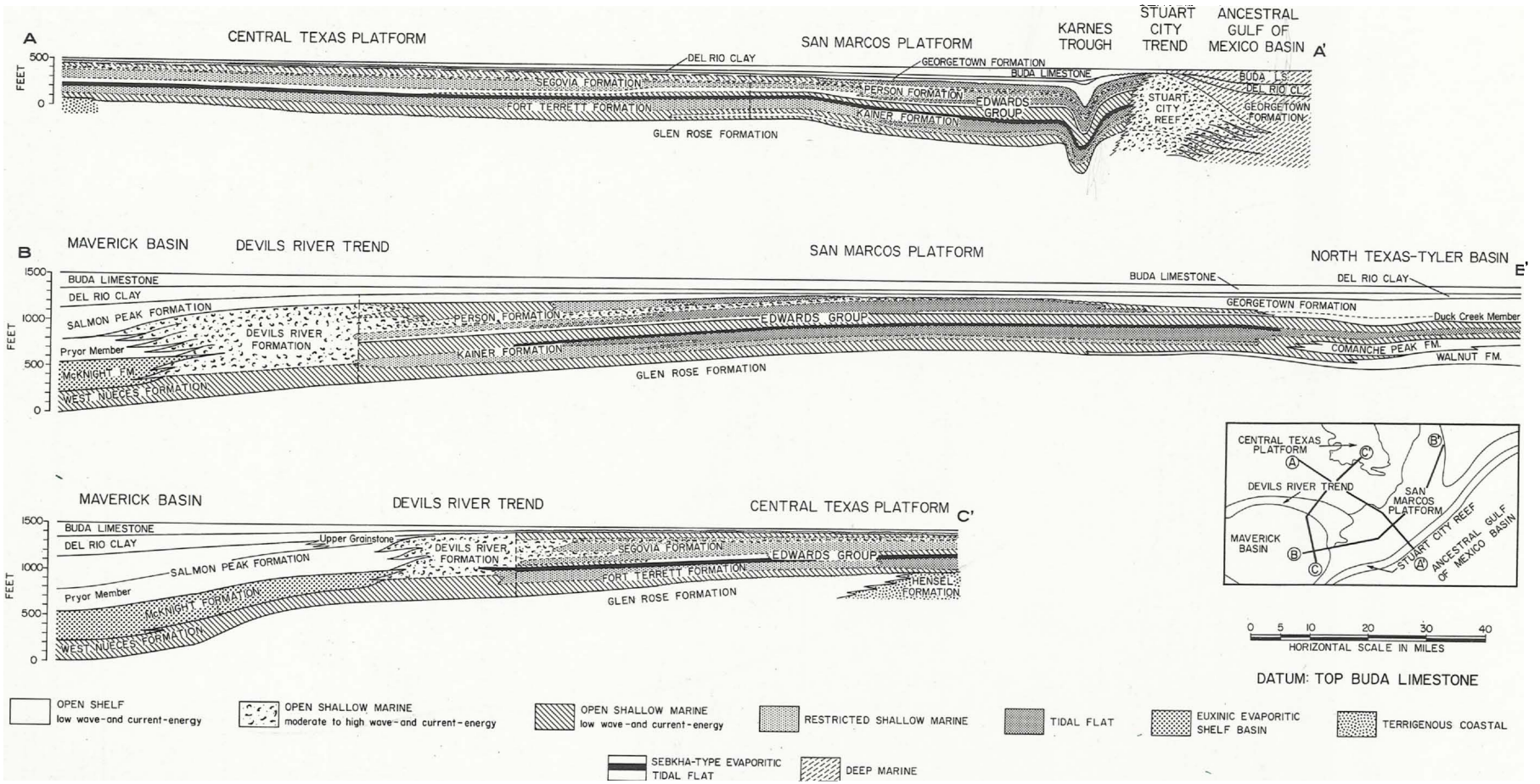


FIG. 33. Regional stratigraphic cross sections.

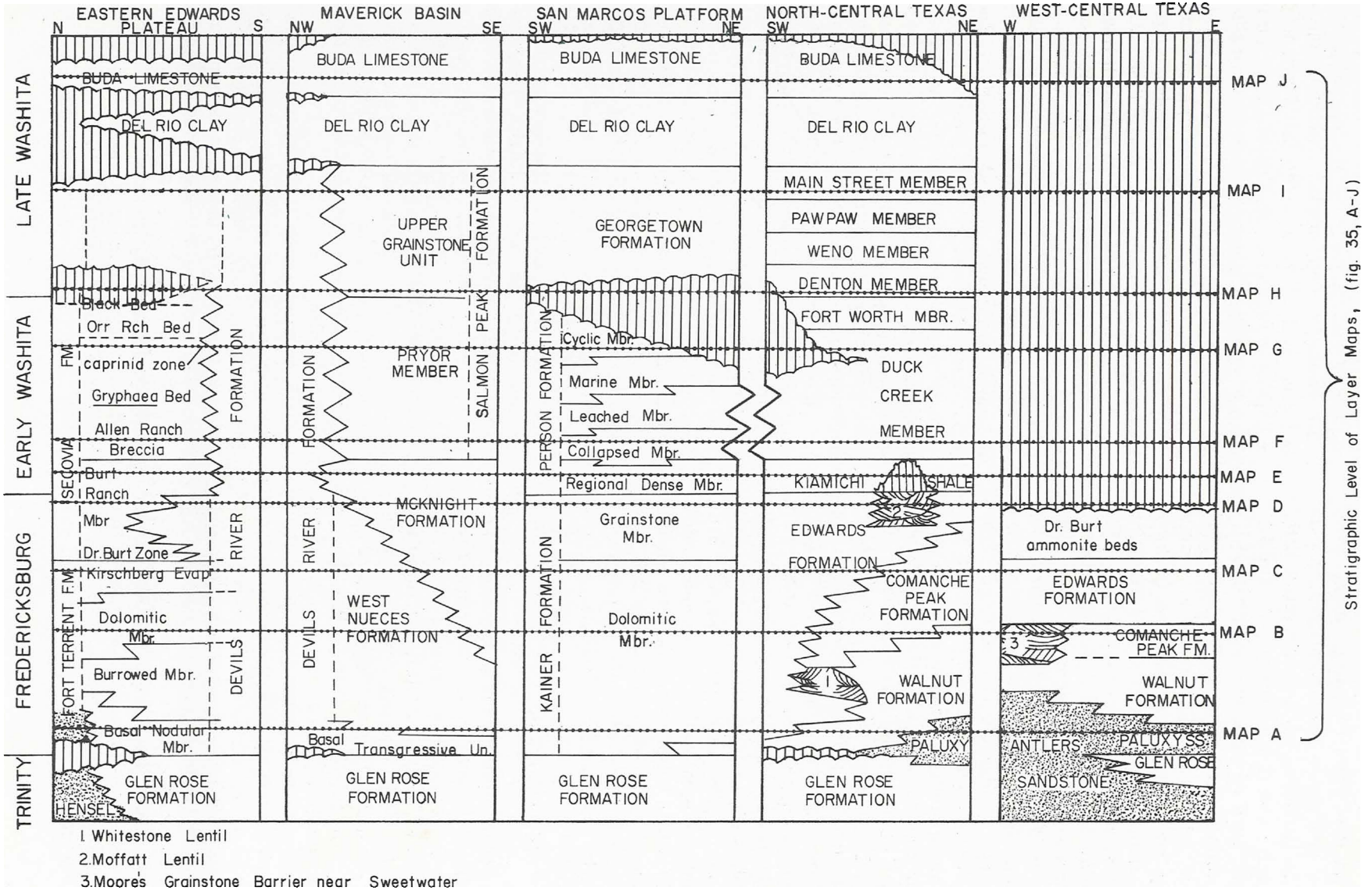


FIG. 34. Fredericksburg-Washita correlation chart.

regional dip is 5 to 10 feet per mile and thin key beds can be traced over thousands of square miles. On such a flat depositional substrate many seemingly random changes in sedimentation and sediment would be produced by the most subtle variations of current, water depth, barriers, or storms.

Accordingly, each of the several members of the Edwards Group reflects not one major geomorphic-sedimentologic environment but rather certain wide-reaching environmental conditions, such as temperature, rainfall, water circulation, terrigenous sediment influx, and subsidence rate, that affected entire broad tracts of the Central Texas Platform. Each member thus represents a complex of environments, and rock types are frequently repeated from member to member. This is the reason why the members do not fit logically into any acceptable migrating facies-tract sequence, why they rest concordantly and in uniform sequence within their respective formations, and why the stratigraphic organization of this paper emphasizes *vertical* rather than horizontal changes.

In constructing the paleogeographic maps (fig. 35, A-J), depositional environments were determined at ten stratigraphic levels (*see* correlation chart, fig. 34) based upon all cores, sampled wells, and measured sections, and the data were then assembled into paleogeographic maps. This approach contrasts with that of Fisher and Rodda (1967, 1969) which emphasized, at least on the southwest side of the Central Texas Platform, one highly generalized lateral sequence of lithofacies within the entire Fort Terrett Formation.

Fredericksburg Time

In the deeper or more rapidly subsiding parts of the Comanche shelf, such as the Maverick basin, North Texas—Tyler basin, or extreme southwest flank of the San Marcos Platform, the transition from Trinity to Fredericksburg time was characterized only by a slight regional deepening of the epeiric sea. In these areas the Glen Rose—Fredericksburg boundary is gradational. Carbonate bank deposition was essentially uninterrupted along the shelf margin (Stuart City Reef), and seaward of the shelf margin, open marine deposition prevailed in the ancestral Gulf of Mexico basin, throughout Fredericksburg and Washita time.

The Fredericksburg sea transgressed swiftly northwestward across slightly eroded Glen Rose tidal flats and other marginal marine deposits on the flanks of the Central Texas Platform. Peripheral to the perennially positive Llano Uplift, sandy and silty basal Fredericksburg sediments were deposited upon a low-relief terrane of terrigenous Trinity sandstone through which projected scattered remnant knobs of Precambrian and Paleozoic rock. But over most of the area the first Fredericksburg sediments consisted of argillaceous lime mud containing abundant clams, oysters, and snails (fig. 35, A). Environment of deposition was calm, shallow open marine. As underlying and outlying terrigenous areas were blanketed, clay content of Fredericksburg seas diminished, and lime mud with common miliolid Foraminifera and shell fragments was deposited in a broad area on the southeast flank of the Central Texas Platform, where shallow-water carbonate shelf deposition thereafter prevailed, in the lee of the protective Stuart City Reef. Some dolomitic sediments were deposited in shallow, highly restricted areas, or upon positive features.

Water was somewhat deeper in the gently subsiding North Texas—Tyler basin, which continued to receive admixtures of clay derived from a terrigenous source to the north. Open-shelf sediments deposited here contain ammonites in addition to a rich mollusc infauna and epifauna. These open-shelf deposits terminated southwestward against low lime-sand banks and oolite shoals that lined the northeast flank of the Central Texas Platform.

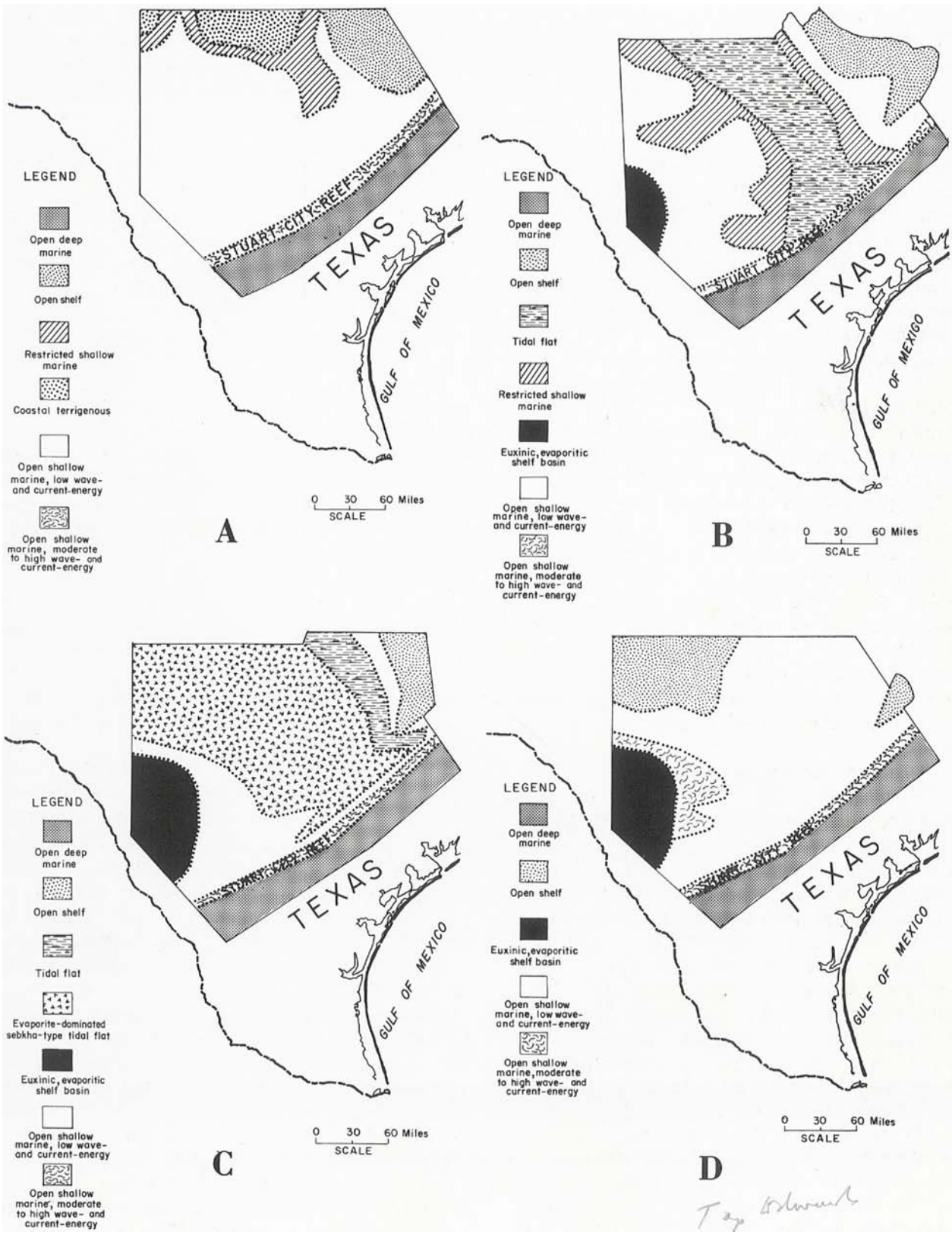
At about this time a gentle, persistent regional shoaling tendency began as several tectonic adjustments occurred: The Maverick basin area, negative in the past, once again began to sag slightly; faulting began (or resumed) along the Karnes and Atascosa troughs; and the Medina axis, if not already positive, began gently to rise (fig. 35, B).

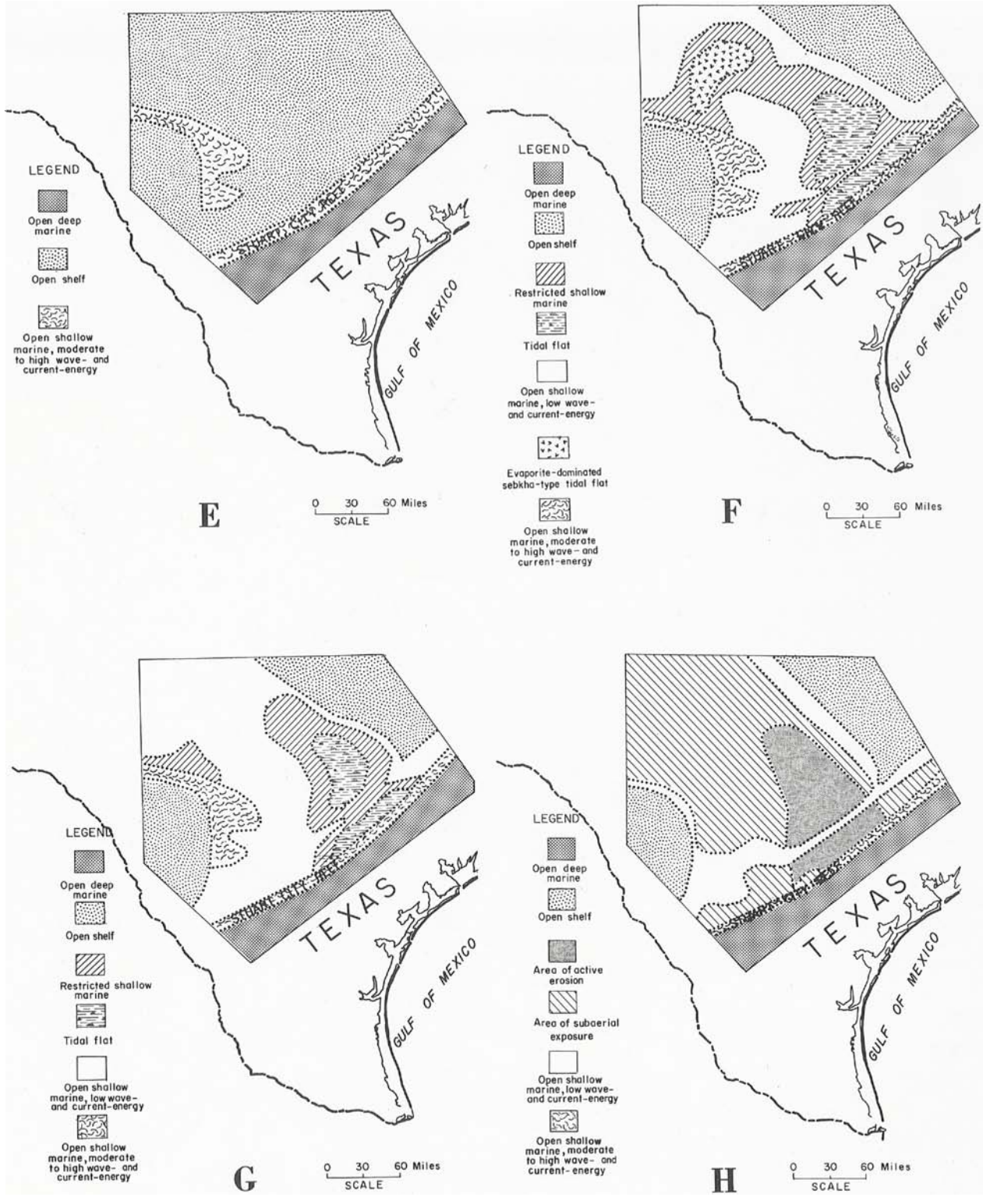
In response primarily to the shoaling, but to the tectonic events as well, dolomitic tidal flat and restricted shallow marine deposits began to accumulate on the axis and southwest flank of the Central Texas Platform. In a large depression in the Comanche shelf (the Maverick basin) that was isolated from marine circulation on three sides by the Stuart City Reef and Central Texas Platform, highly evaporitic, calm, euxinic conditions produced the lower McKnight Formation.

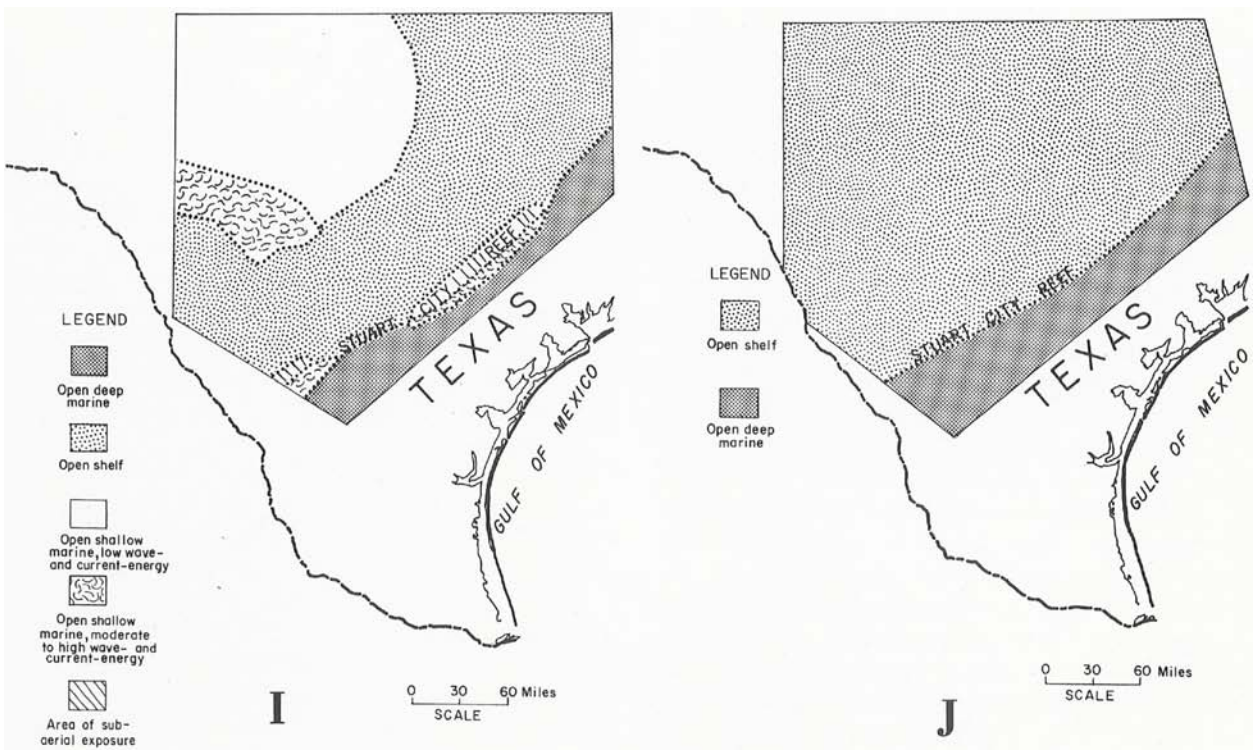
Open shallow-marine deposits began to accrete northeastward from the San Marcos Platform out into slightly deeper water of the North Texas—Tyler basin, and linear lime-sand barriers were constructed along the northeast flank of the Central Texas Platform that further restricted circulation of marine water onto the platform.

As the regional shoaling tendency continued, increasingly shallow, restricted and evaporitic depositional conditions prevailed (fig. 35, C). Beds of

FIG. 35. Layer maps showing distribution of Fredericksburg-Washita facies tracts (A - J).




LEGEND
Open deep marine
Open shelf
Open shallow marine, moderate to high wave- and current-energy
TEXAS
GULF OF MEXICO
0 30 60 Miles
SCALE
E
LEGEND
Open deep marine
Open shelf
Restricted shallow marine
Tidal flat
Open shallow marine, low wave- and current-energy
Evaporite-dominated sebkha-type tidal flat
Open shallow marine, moderate to high wave- and current-energy
TEXAS
GULF OF MEXICO
0 30 60 Miles
SCALE
F
LEGEND
Open deep marine
Open shelf
Restricted shallow marine
Tidal flat
Open shallow marine, low wave- and current-energy
Open shallow marine, moderate to high wave- and current-energy
TEXAS
GULF OF MEXICO
0 30 60 Miles
SCALE
G
LEGEND
Open deep marine
Open shelf
Area of active erosion
Area of subaerial exposure
Open shallow marine, low wave- and current-energy
Open shallow marine, moderate to high wave- and current-energy
TEXAS
GULF OF MEXICO
0 30 60 Miles
SCALE
H


LEGEND
Open deep marine
Open shelf
Open shallow marine, low wave- and current-energy
Open shallow marine, moderate to high wave- and current-energy
Area of sub-aerial exposure
STUART CITY LUTHER REEF TRACT
TEXAS
GULF OF MEXICO
0 30 60 Miles
SCALE
I
LEGEND
Open shelf
Open deep marine
STUART CITY REEF
TEXAS
GULF OF MEXICO
0 30 60 Miles
SCALE
J

euxinic limestone, gypsum, and salt were deposited in the expanding, sinking Maverick basin; highly evaporitic, sebkha-like tidal flats covered much of the axis of the Central Texas Platform, and its southwestern flank was a vast, extremely shallow restricted sea. The restricted, evaporitic conditions reached a climax with the widespread deposition of Kirschberg Evaporite on the Central Texas Platform.

Sea level rose and normally saline water returned to the Central Texas Platform. Deposits at first consisted of layers of very fine lime mud, but sea water dissolved much of the barely covered gypsum, resulting in the collapse of these overlying layers.

Rates of carbonate accumulation decreased sharply as waters grew deeper, and mud layers lay exposed to submarine alteration across a broad area on the northwest end of the platform, resulting in submarine lithification and scattered bored and corroded surfaces. With continued flooding open marine marly lime mud (Burt Ranch Member) was deposited on the northwest end of the Central Texas Platform, but over structurally positive, shallower areas such as the Devils River trend or Medina axis particulate lime-sand bodies and rudist banks formed instead of marl (fig. 35, D). Toward the San Marcos Platform and in the lee of the Stuart City Reef, deposition of Burt Ranch marl and miliolid lime sands alternated, and the deposition of lime sand replaced that of marl progressively to the south and east. This facies change was produced primarily because the shallow marine area in the lee of the Stuart City Reef became one of very high carbonate productivity, and sediment tended to be trapped in the lee of the protective banks. Dark lime mud accumulated in the Maverick basin.

Toward the end of Fredericksburg time, the subsidence rate of the southeast end of the San Marcos Platform increased, but accumulation of skeletal carbonate sediment and weathered lithoclasts derived from the partly exposed Stuart City Reef was able to match subsidence. Eventually a brief still-stand produced a broad, flat surface of by-passing, submarine exposure and alteration on the axis and northeast flank of the San Marcos Platform. This flat surface of by-passing was then covered by open-shelf marine seas of shallow to moderate depth, signalling the end of the Fredericksburg and the beginning of Washita time.

Early Washita Time

The widespread flooding of the Comanche shelf lasted only briefly and resulted in the deposition of a thin blanket of argillaceous lime mud (Regional Dense Member, Kiamichi Shale, upper Burt Ranch Member, upper McKnight Formation) over most of the area (fig. 35, E). Along the Devils River belt and the Stuart City Reef, however, rudist banks and skeletal lime sand were deposited as part of continuing carbonate bank deposition there.

Several related tectonic and depositional events now followed (fig. 35, F):

(1) The Karnes and Atascosa troughs began to subside actively.
(2) The subsidence rate of the southwest flank of the Central Texas Platform began not only to increase but also to accelerate progressively southwestward.
(3) The axis of the San Marcos Platform began to rise very gently.
(4) Clinoforms were established on both flanks of the Central Texas Platform at the margins of the Maverick and North Texas—Tyler basins.
(5) The gentle uplift of the Devils River belt that began during late Fredericksburg continued, insuring the permanent shift of the primary belt of rudist-bank deposition across the Maverick basin to the Devils River belt. Some rudist-bank deposition continued, however, on the slowly submerging southwestern end of the Stuart City Reef.
(6) Despite the overall retreat of shallow-water facies tracts toward the axis of the Central Texas Platform, a considerable area of tidal flats remained on the axis of the San Marcos Platform in the lee of the Stuart City Reef, and a large sinuous area of restricted shallow marine deposits followed the Central Texas Platform northwestward from the Stuart City to the Llano Uplift, where it deflected southwestward, faithfully reflecting the influence of the Medina axis. Dolomitization was an active contemporary process in both facies tracts.

Restricted platform interior deposits became fairly widespread, as the Devils River and Stuart City belts once again protected and isolated the platform interior and formed an effective shallow-water "sediment trap" in a wedge-shaped area on the San Marcos Platform northwest of the Stuart City Reef and east and northeast of the Devils River belt. Gypsum formed locally in scattered intertidal lakes and puddles and in sebkha-like supratidal flats. Most of the gypsum was removed soon thereafter, either through subaerial exposure and solution by ground water, or through solution by normally saline sea water; the result was collapse breccia (Collapsed Member of Person Formation,

Allen Ranch Breccia). West of what is now South Llano River somewhat more open circulation prevailed, so that lime mud accumulated instead of dolomite and gypsum.

While restricted shallow marine deposition continued on the platform, shallow marine lime sand and rudist banks were deposited at the platform margins and on clinoforms descending from the platforms into the North Texas—Tyler basin and Maverick basin. Full marine, fondoform sediments in the Maverick basin consisted of clay-free lime mud rich in *Globigerina*, and similar but argillaceous pelagic lime mud accumulated in the North Texas—Tyler basin.

Overall, accumulation of carbonate sediments in the platform interior could not match subsidence, and facies tracts retreated toward structurally positive areas (fig. 35, G). Near the end of early Washita time there were still tidal flats in the lee of the Stuart City Reef, on the crest of the San Marcos Platform, and probably behind the Devils River barrier.

Late Washita Time

Shallow seas withdrew from the San Marcos Platform as the axis rose by as much as 100 feet in the area just north of the Stuart City Reef (fig. 35, H). The Cyclic and Marine Members were progressively stripped away from the axis of the platform, and a broad surface of erosion developed on top of the Person Formation. The Cyclic and Marine Members were preserved, however, in the still-subsiding Karnes trough. The area of most active erosion occupied roughly the same area as the tidal flats and restricted shallow marine areas of the Person Formation, but exposure and perhaps minor erosion were probably occurring simultaneously to the northwest (Black Bed) in what is now the Edwards Plateau.

As erosion wore down the axis of the San Marcos Platform and sea level rose, open-shelf lime mud deposits (upper Duck Creek and Fort Worth Members) were gradually ascending the clinoform on its northwest flank; similar open-shelf deposits were accumulating on the flank of the Maverick basin clinoform (upper Salmon Peak Formation).

As sea level continued its gradual rise open-shelf lime muds continued to encroach and finally covered the southeastern part of the Central Texas Platform (fig. 35, I) with a thin blanket of slightly argillaceous lime mud containing ammonites, *Globigerina*, and abundant clams, oysters, and snails (Georgetown Formation). To the northwest this thin blanket consisted of bioclastic lime sands and muds that reflect shallower, more agitated depositional conditions (uppermost Segovia). Some areas may not have been covered, such as islands on that part of the Stuart City Reef that fronts the San Marcos Platform, and similar mounds that probably existed on the Devils River bank. A thin widespread interval of lime sand at the top of this blanket reflected a gentle regional shoaling and generally higher wave and current energy.

As sea level continued to rise, open marine terrigenous sediment, mostly clay, was deposited over the entire area (Del Rio Clay); the higher parts of the Comanche shelf were covered last. Continued uplift of the northern flank of the Devils River belt and the DuBose Field area on the northwest flank of the Stuart City Reef caused erosion and removal of some or all of the Del Rio and some of the upper Segovia or upper Georgetown. A thin sheet of open-shelf lime mud (Buda Limestone) then blanketed the entire area until the end of late Washita time (fig. 35, J). Even though the Comanche shelf was flooded by shallow marine seas, the shelf margin probably continued to act as an ecologic barrier that prevented the ready ingress of cosmopolitan oceanic forms during the late Washita.

Conclusion

The history of Fredericksburg and Washita deposition in Central Texas is, simply, the ultimate inundation of a very broad but otherwise typical carbonate facies complex on the Central Texas Platform during three stages of successively deeper-water deposition (Rose, 1968b). For the most part shallow-water shelf facies tracts simply retreated gradually onto remaining positive areas as water became deeper, but in a few areas new facies tracts developed suddenly in response to increased water depth or changes in water circulation. Following several alternating periods of exposure and flooding by shallow open seas, the Central Texas Platform was finally submerged in late Washita time.

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PLATES 5-19

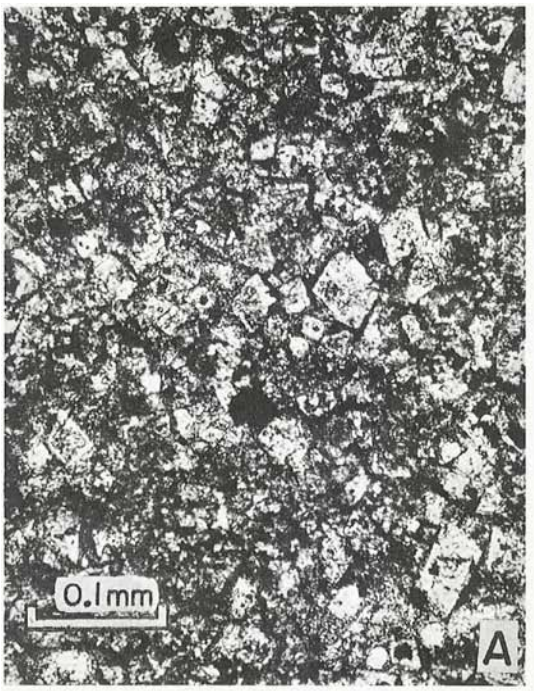
PLATE 5

A. Thin section: massive, homogeneous, fine-crystalline dolomite from Dolomitic Member of Kainer Formation; Southern Production Company No. 6 Jolley, Caldwell County; depth 1,588 feet. x180.

B. Core slab: dolomitized supratidal sequence with stromatolitic hard crust and desiccation marks (bird's-eye structure) from Dolomitic Member of Kainer Formation; Southern Production Company No. 6 Jolley, Caldwell County; depth 1,696 feet. x0.9.

C. Acetate peel: miliolid biosparite with intraclasts from Grainstone Member of Kainer Formation; Tenneco No. 1 Jambers Gas Unit A, McMullen County; depth 11,388 feet. x55.

D. Core slab: coated clasts from Grainstone Member of Kainer Formation; General Crude No. 1 Mitting, DeWitt County; depth uncertain—about 10,725 feet. x0.9.


0.1mm
A

1 mm
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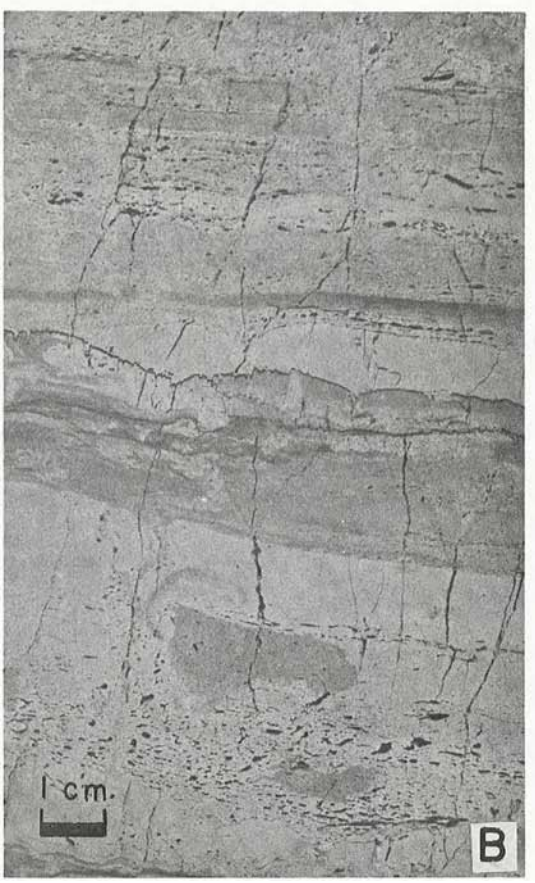
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B

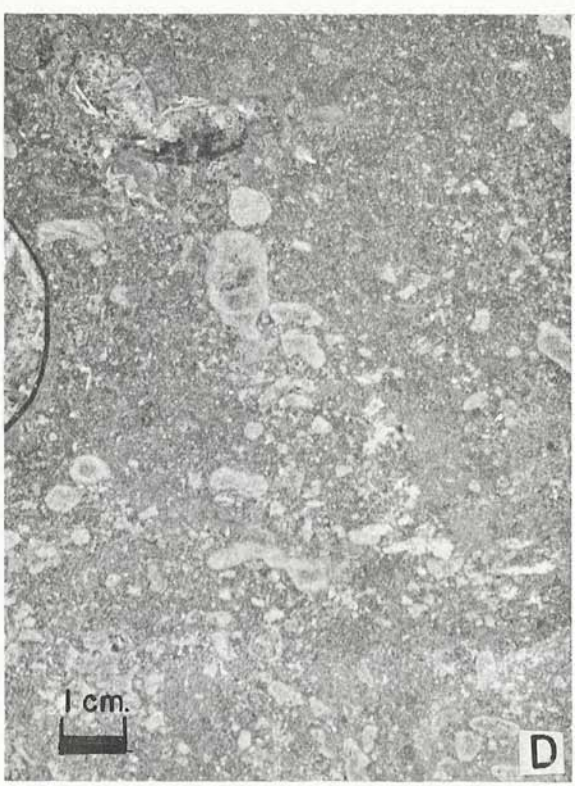

1 cm.
D

PLATE 6

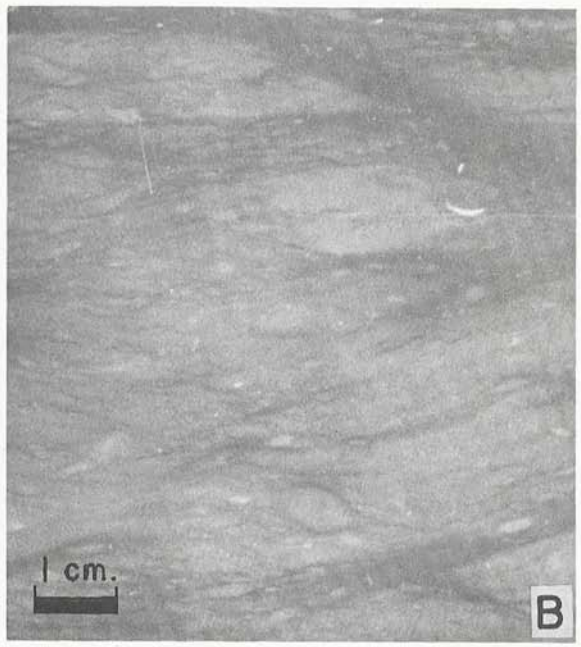
A. Core slab: boundary between Kainer and Person Formations is indicated by arrow; note also coated clasts in matrix above boundary; Brazos No. 1 Person, Karnes County; depth 10,977 feet. x1.

B. Core slab: wispy, pelleted micrite with scattered fine mollusc fragments from Regional Dense Member of Person Formation; Standard of Texas No. 1 Wiatrek, Karnes County; depth 10,990 feet. x1.1.

C. Acetate peel: Regional Dense Member of Person Formation; Standard of Texas No. 1 Wiatrek, Karnes County; depth 10,990 feet. x2.8.

D. Core slab: wispy, pelleted micrite with scattered fine mollusc fragments from Regional Dense Member of Person Formation; U. S. Corps of Engineers No. 1 Selma core hole, Bexar County; depth 442 feet. x1.6.

1 cm.
A


1 cm.
B

1 cm.
C

1 cm.
D

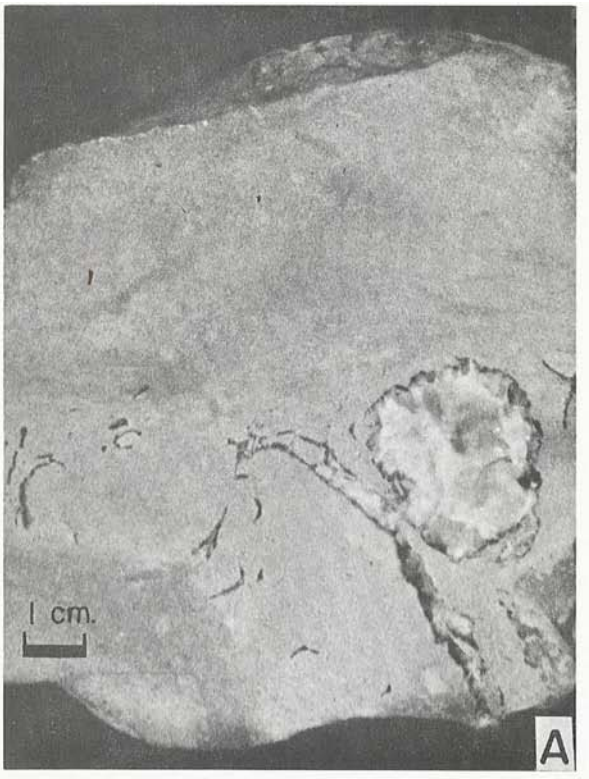
PLATE 7

A. Core slab: massive dolomite with spar-filled cavity that probably represents former gypsum nodule subsequently dissolved; Leached Member of Person Formation; Shell No. 1 Roberts, Karnes County; depth 10,836 feet. x0.8.

B. Core slab: massive dolomitized micrite with partly leached mollusc shell fragments and possible orbitolinid foraminifers characteristic of the Leached and Cyclic Members of the Person Formation; Shell No. 1 Roberts, Karnes County; depth 10,740 feet. x1.2.

C. Core slab: whole-rudist biomicrite and biomicrosparite from Marine Member of Person Formation; Standard of Texas No. 1 Wiatrek, Karnes County; depth 10,864 feet. x0.8.

D. Core slab: current-streaked rudist-fragment biosparite and wispy biomicrite from Marine Member of Person Formation; rudists are chiefly caprinids; Standard of Texas No. 1 Wiatrek, Karnes County; depth 10,862 feet. x1.


1 cm.
A

1 cm.
C

1 cm.
B

1 cm.
D

PLATE 8

A. Core slab: disrupted, former gypsum-bearing zone in supratidal sequence; this rock type is characteristic of Dolomitic Member of Kainer Formation and Collapsed and Cyclic Members of Person Formation; Tenneco No. 1 Ullman, Gonzales County; depth 12,073 feet. x0.9.

B. Core slab: supratidal stromatolitic hard crust sequence characteristic of Dolomitic Member of Kainer Formation and Collapsed and Cyclic Members of Person Formation; Southern Production Company No. 6 Jolley, Caldwell County; depth 1,682 feet. x0.8.

C. Core slab: burrowed intertidal dolomite characteristic of Dolomitic Member of Kainer Formation and Leached and Cyclic Members of Person Formation; General Crude No. 1 Mitting, DeWitt County; depth 11,560 to 11,655 feet. x0.9.

D. Core slab: dolomite-filled burrows in dolomitic micrite; burrow fillings are coarser grained than micrite matrix; light-colored micrite must have been somewhat cohesive or "stiff" before overlying layer was deposited, in order for burrows to have been maintained; Person Formation; Mobil No. 40 Mercer, Caldwell County; depth 2,146 feet. x1.

1 cm.
A

1 cm.
C

1 cm.
B

1 cm.
D

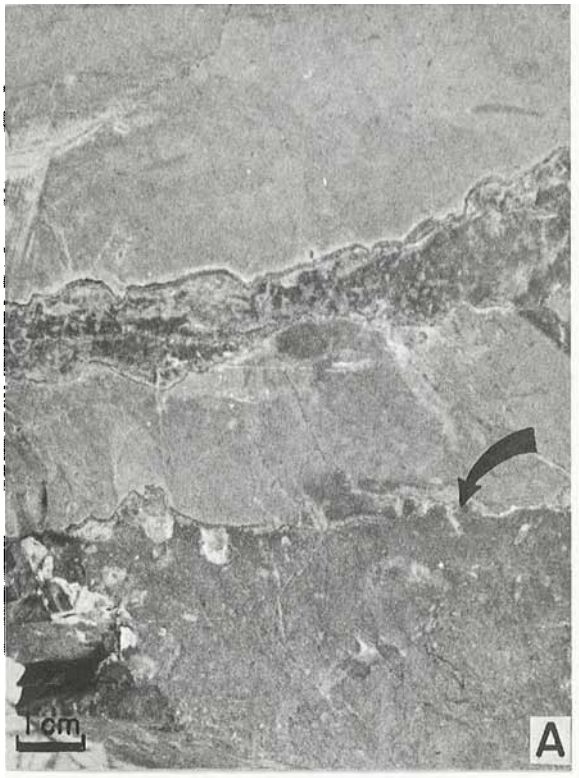
PLATE 9

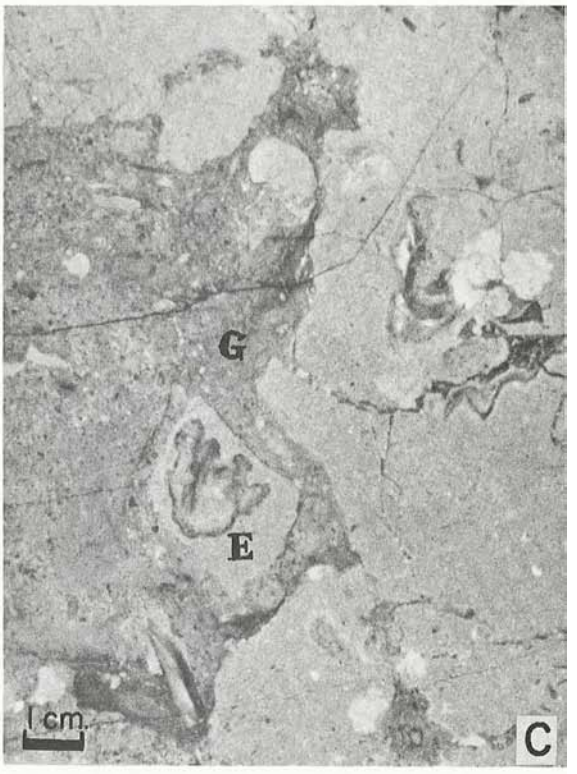
A. Core slab: arrow indicates Edwards-Georgetown boundary; note truncated shell fragments; Shell No. 2 Urbanczyk, Karnes County; depth 10,735 feet. x0.9.

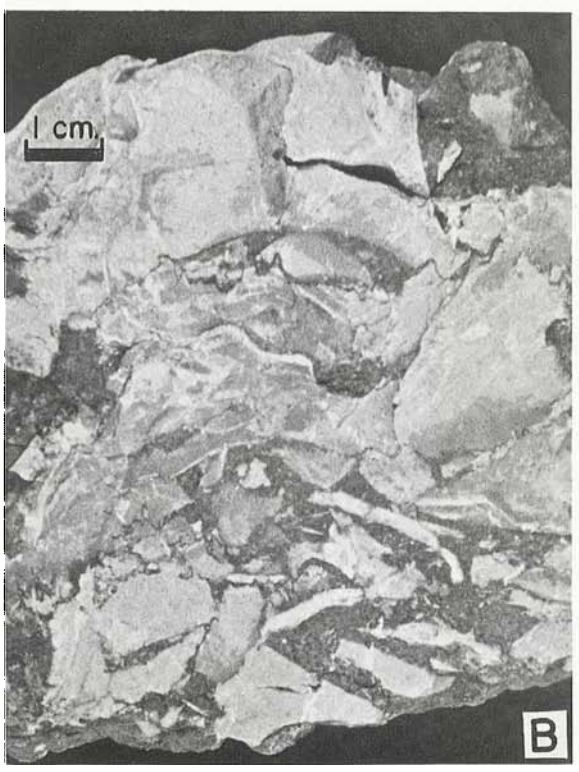
B. Core slab: soil zone at top of Edwards Group; fragments are angular lithoclasts and mollusc fragments; matrix is granular, rotten, slightly friable microspar; Standard of Texas No. 1 Wiatrek, Karnes County; depth 10,776 feet. x1.

C. Core slab: cavity 3 feet below top of Edwards filled with Georgetown micrite (G); note loose Edwards clasts (E) "floating" in Georgetown matrix; Shell No. 2 Urbanczyk, Karnes County; depth 10,738 feet. x0.8.

D. Acetate peel: characteristic Georgetown micrite with *Globigerina* tests (G) and microspherulites, probably calcispheres (C); Amerada No. 1 Harper, Karnes County; depth 10,890 feet. x5.4.


1 cm.
A


G
E
1 cm.
C


1 cm.
B

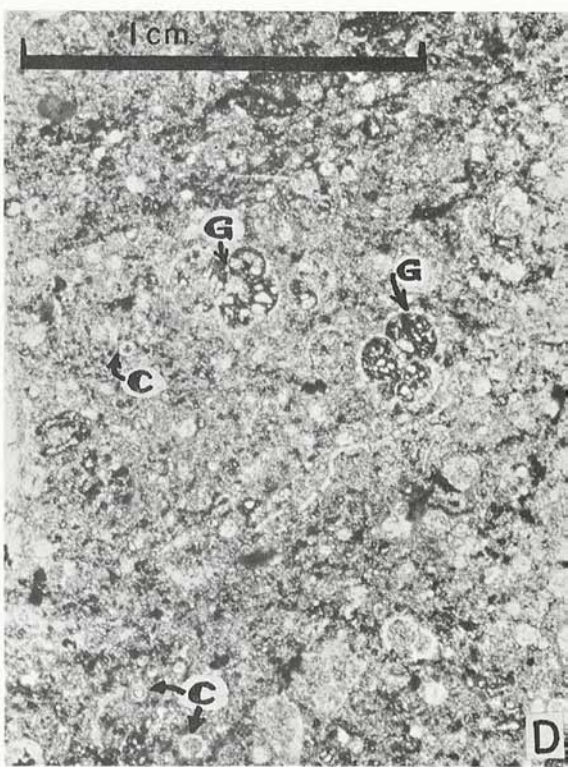

1 cm.
G
G
C
C
D

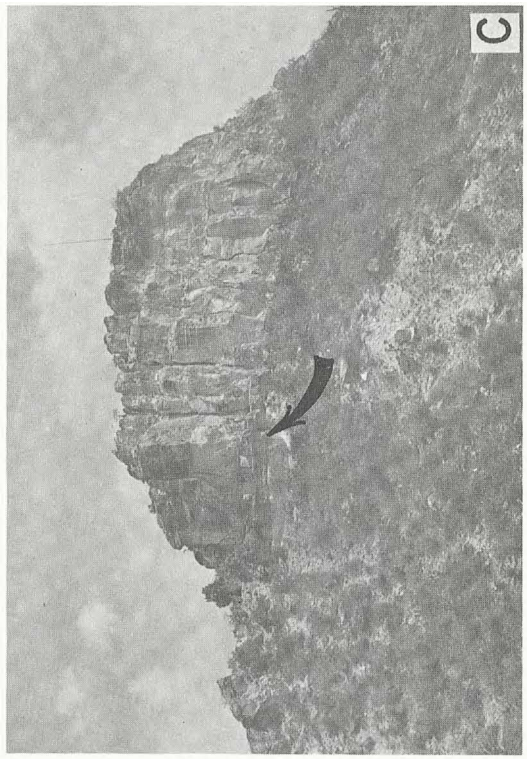
PLATE 10

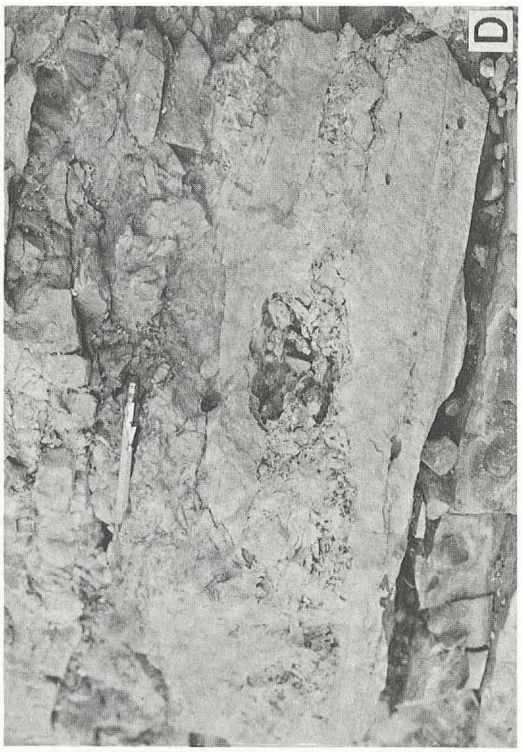
A. Cracks in uppermost Glen Rose filled with marl from overlying basal Fort Terrett Formation; locality 64 on Johnson Fork about 2 miles south of Mountain Home, Kerr County.

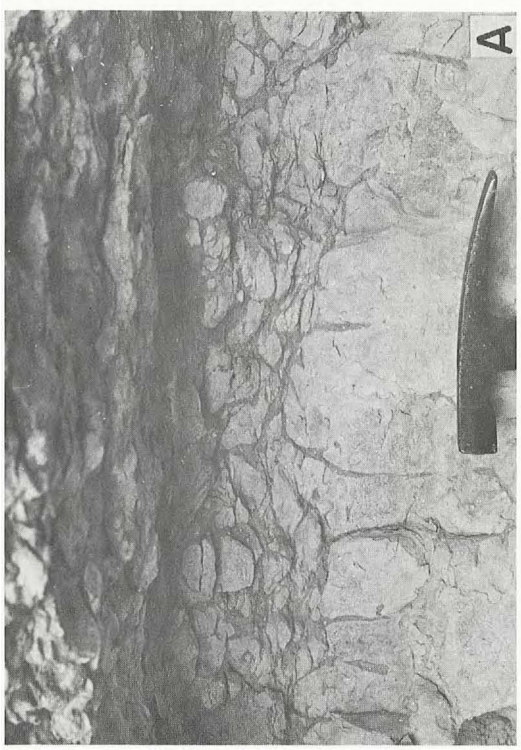
B. "Honeycomb limestone" produced by preferential leaching of burrow fillings in Burrowed Member of Fort Terrett Formation at WF-89 (West Frio section), Real County.

C. Base of Edwards at "Lover's Leap," Junction, Kimble County; arrow indicates lower boundary of group.

D. Micro-collapse breccia filling cavities; probably created by solution of gypsum nodules that contained some interstitial carbonate sediment; in Dolomitic Member of Fort Terrett Formation at WS-169 (West Sister Creek section), Kendall County.


C


D


A

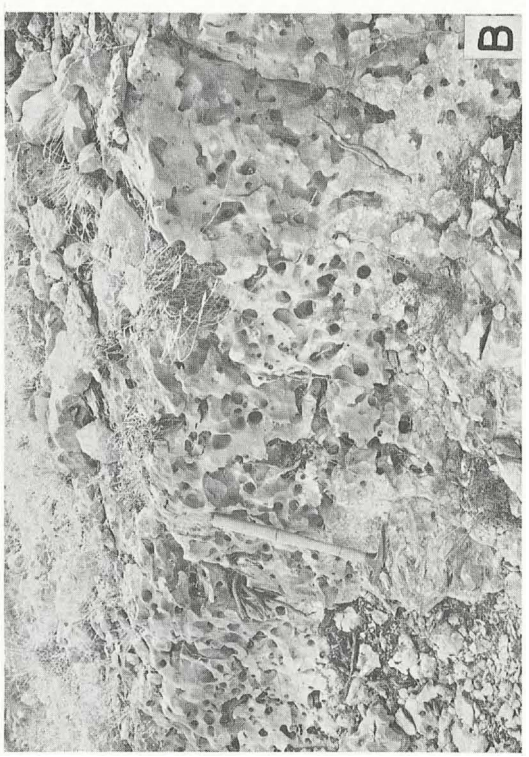

B

PLATE 11

A. Collapse breccia composed of porcellaneous micrite; Kirschberg Evaporite; pencil indicates scale; exposures beside graded county road about 200 yards northwest of locality 37, Kimble County.

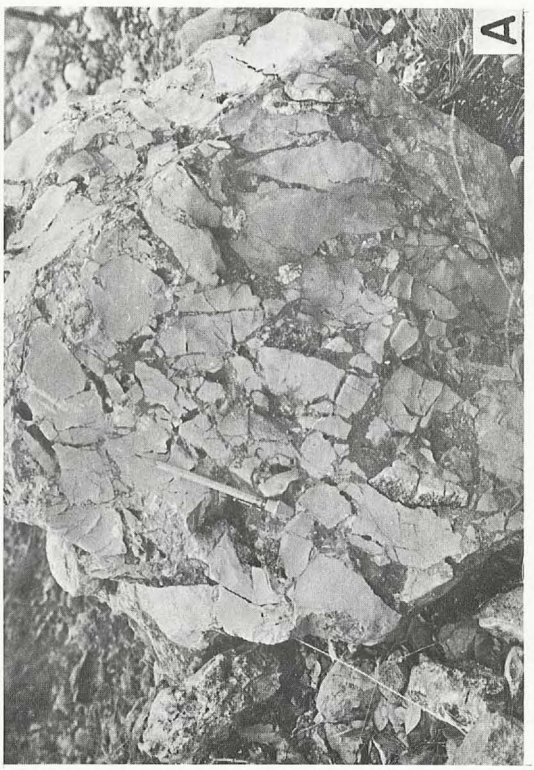
B. Incipient breccia in porcellaneous micrite of upper Kirschberg at locality 9, Kimble County.

C. Plan view of bored bed in middle of Burt Ranch Member at MM-267 (Medina Mountain section); successive truncations of borings indicate at least three episodes of boring of this surface. x1.7.

D. Cross section of bored bed shown in (C) above; shells of *Lithophaga*-type bivalves are still present in some borings. Superimposed borings or "bored borings," well developed in this slab, indicate either on-going boring and submarine lithification or repeated fluctuations in sea level so as to account for subaerial lithification of sediment inside borings before truncation by succeeding boring. x1.7.

C
1 cm.

D
1 cm.


A

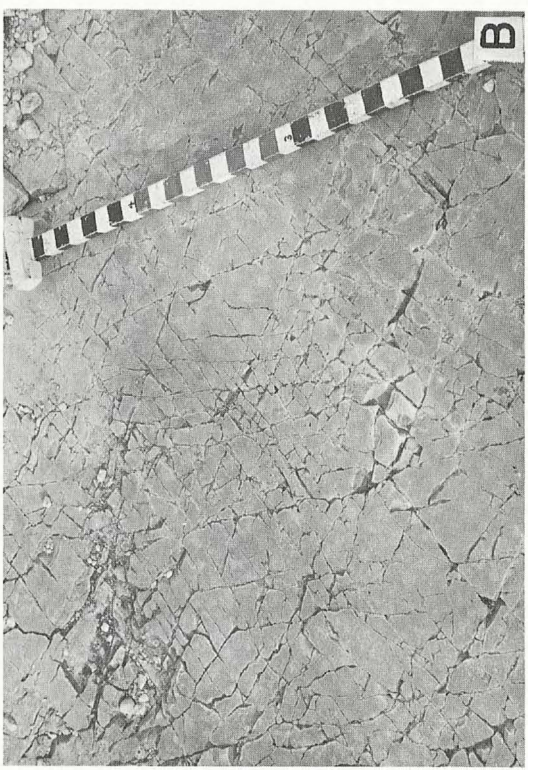

B

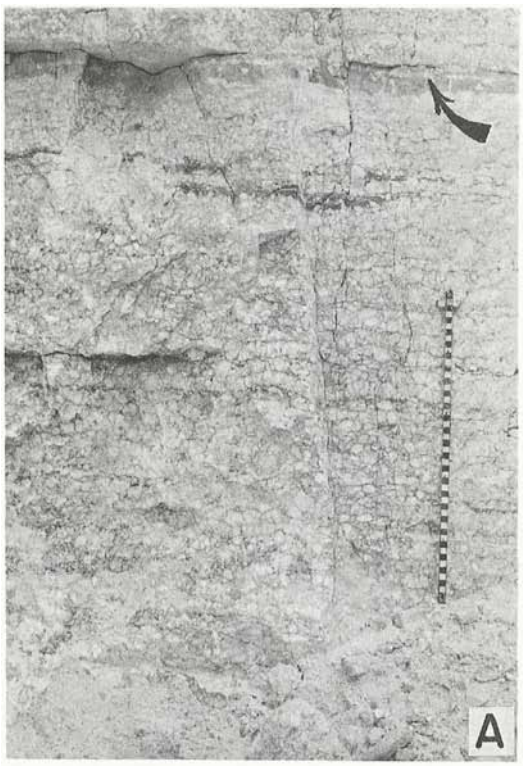
PLATE 12

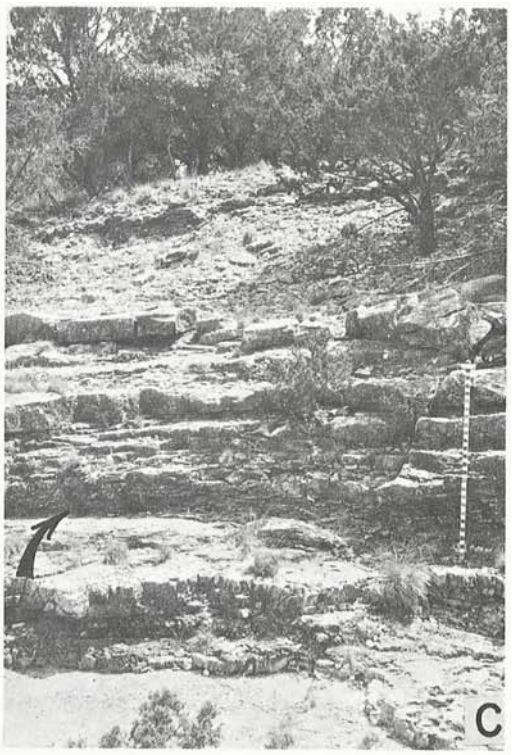
A. Massive, nodular to "augen-structured" Kirschberg gypsum with thin dolomite lenses (arrow); Gypsum Quarry measured section, at quarry of the Fredericksburg Gypsum Company, Gillespie County.

B. Acetate peel: miliolid biosparite with scattered intraclasts and mollusc fragments; from thin limestone beds in Burt Ranch Member, MM-263 (Medina Mountain section), Kerr County. x4.6.

C. Characteristic upper Kirschberg/Burt Ranch sequence; incipient breccia in creek bed; arrow indicates base of Burt Ranch; recessive slope above is typical weathering profile of Dr. Burt marl; locality 9, Kimble County.

D. Burt Ranch Member at the type area (locality 9) on old Dr. Fred Burt ranch; Kimble County. Base of bluff is very near base of member.


A


C

B
0.5 mm

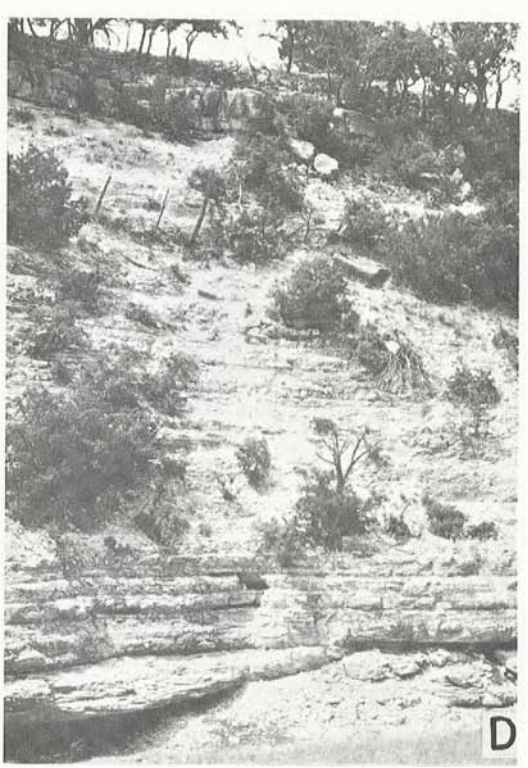

D

PLATE 13

A. Accretion beds at top of "middle limestone" of Burt Ranch Member dip to left (south) at about 5 degrees; Tommy Priour segment 2 of North Fork composite section, Kerr County.

B. Low angle accretion beds (indicated by lines) in "middle limestone" of Burt Ranch Member dip to left (east) at about 5 degrees; arrows indicate base of member; locality 61 on North Fork of Guadalupe River, Kerr County.

C. Photomicrograph showing boring that still contains resident *Lithophaga* bivalve (arrow L); note truncation of earlier boring (arrow T) as well as truncation of shell fragments (arrow S) in matrix filling the first boring, indicating matrix must have been lithified when the second boring was made. x20.

D. Massive ledge capping hill is "middle limestone" of Burt Ranch Member; "lower marl" forms slope below massive ledge; base of Burt Ranch Member indicated by arrow (DB) and base of Fort Terrett is shown by arrow (FT) at base of bluff to right; Brewington Creek about 2 miles north of North Fork of Medina River, Bandera County.

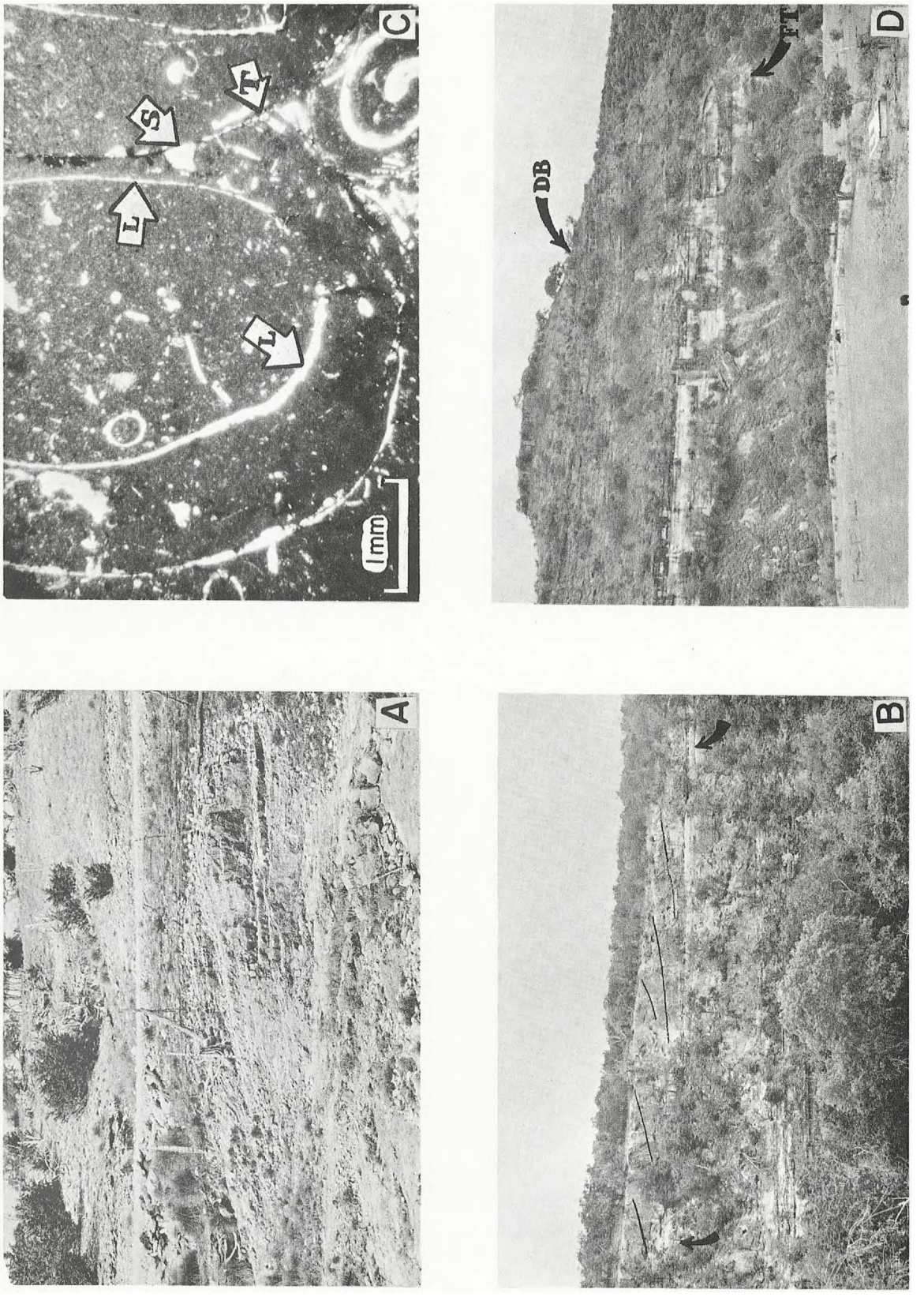

A
B
C
L
S
T
L
1mm
D
DB
FT

PLATE 14

A. Allen Ranch Breccia at the type locality; intersection segment of Joy Creek composite section, Kimble County.

B. Slab of type Allen Ranch Breccia; matrix is fine crystalline limestone; clasts are chert (c) and porous dolomitic crystalline limestone (x); note that some limestone clasts appear to grade into matrix; intersection segment of Joy Creek composite section (I-29). x1.3.

C. Mounds, probably algal, with thin micrite-draped beds in intermound areas; Segovia Formation at BC 99-102 (Bee Caves Ranch section), Real County.

D. Large block of the *Gryphaea* Bed with silicified oyster shells weathering out from matrix; Henry Kast ranch, northeastern Edwards County.

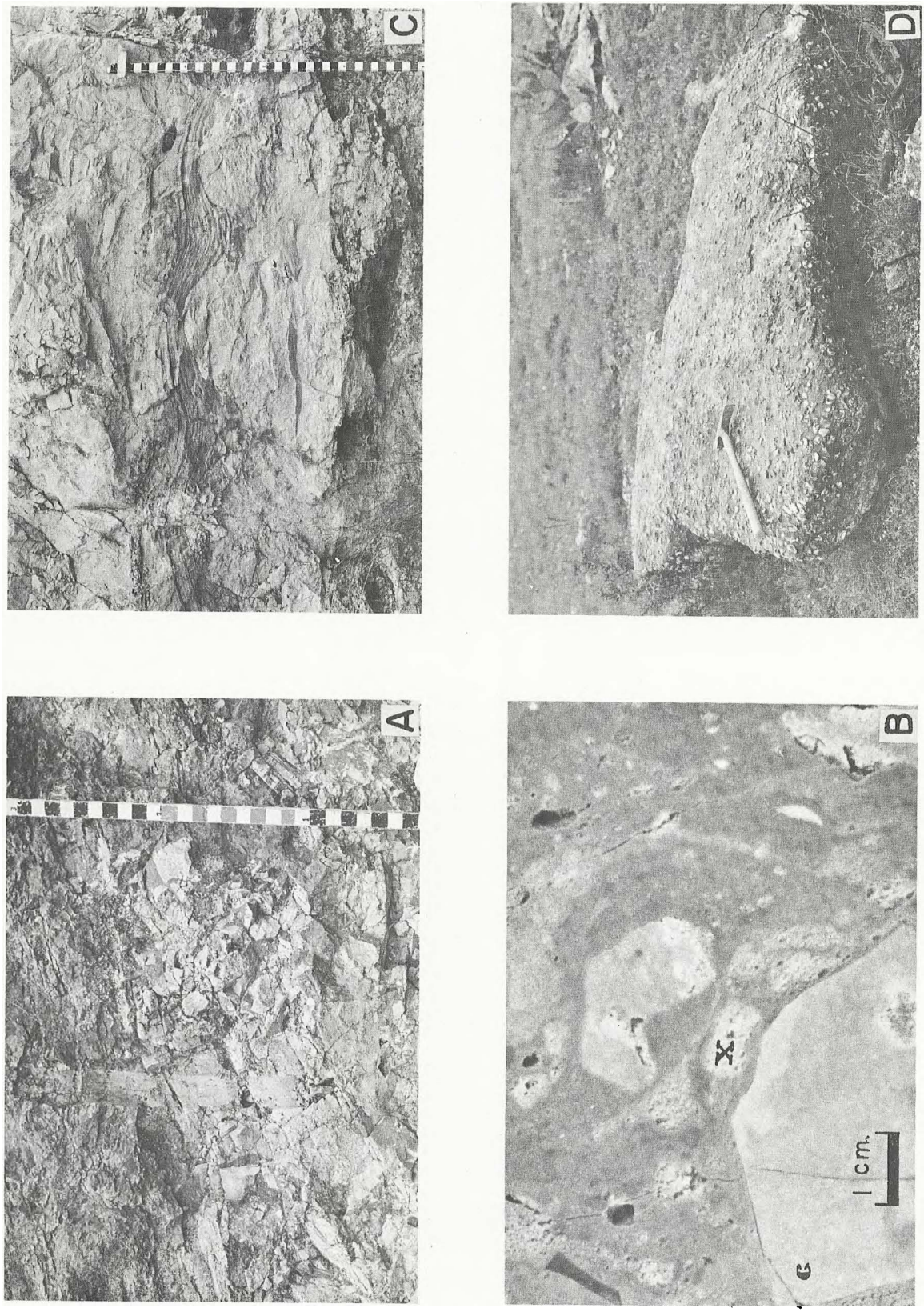

A
B
X
1 cm.
C
D

PLATE 15

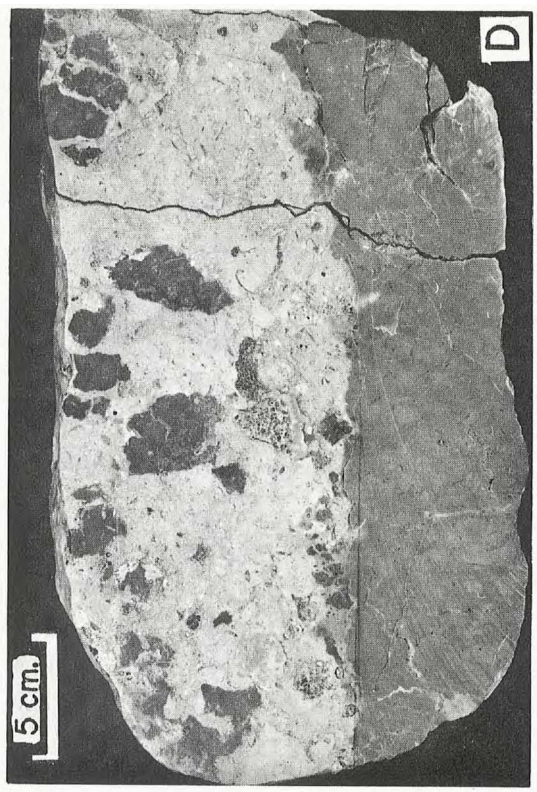
A. Limestone, dolomite, and chert pebble conglomerate in caliche matrix that occurs at level of the *Gryphaea* Bed at locality 27, YO ranch, Kerr County; some clasts are coated. x1.

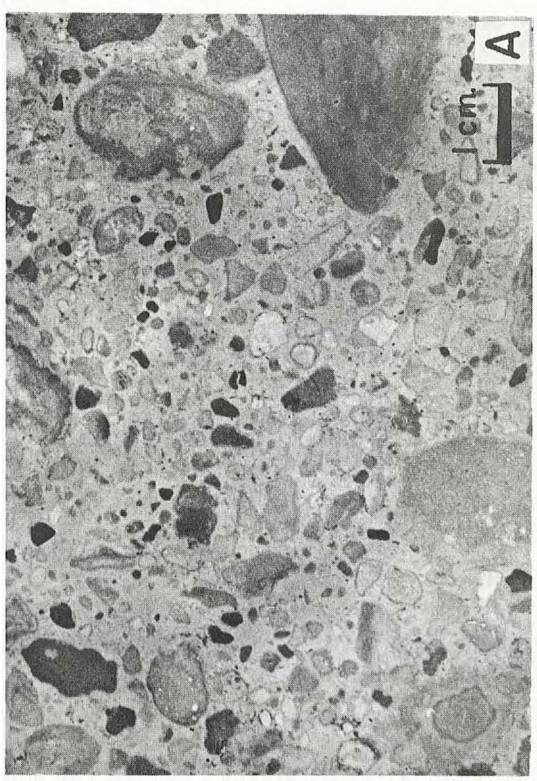
B. Silicified caprinids from rudist mound at locality 43, Kerr County.

C. Black Bed; large rounded blocks of dark gray to black micrite at locality 69, ¼ mile west of Will Auld ranch headquarters, Kerr County; 2½ miles south of Garven Store.

D. Unconformable contact associated with the "Calvert Slope" and the Black Bed; large lithoclasts of Black Bed lithology are incorporated into coarse calcarenite just above the disconformity. Horizontal and curved marks on slab are saw-marks. Quarry at locality 68 about ¼ mile southwest of Garven Store, Real County. x0.3.

C


D
5 cm.


A
1 cm.

B

PLATE 16

A. Irregular, severely bored boulder of Black Bed micrite incorporated into coarse calcarenite; locality 69, ¼ mile west of Will Auld ranch headquarters, Kerr County, 2½ miles south of Garven Store. x0.2.

B. Bored flat cobble of reddish-brown, laminated, silty Del Rio micrite in basal Buda just above and left of top of pen; note cobble is bored on top as well as bottom; Lee Hyde quarry, locality 17, Edwards County.

C. Erosional contact between Segovia Formation and Buda Formation; hammers rest on disconformity (marked by dotted line); note truncation of Segovia beds; Lee Hyde quarry, locality 17, Edwards County.

D. Soft, lumpy, bouldery zone, probably a regolith, at top of Del Rio about 1 mile east of where Del Rio pinches out; locality 18, Real County.

E. Acetate peel showing micrite with scattered fragile mollusc fragments, characteristic of Buda Formation; YO 4-17 (YO section), Kerr County. x5.6.

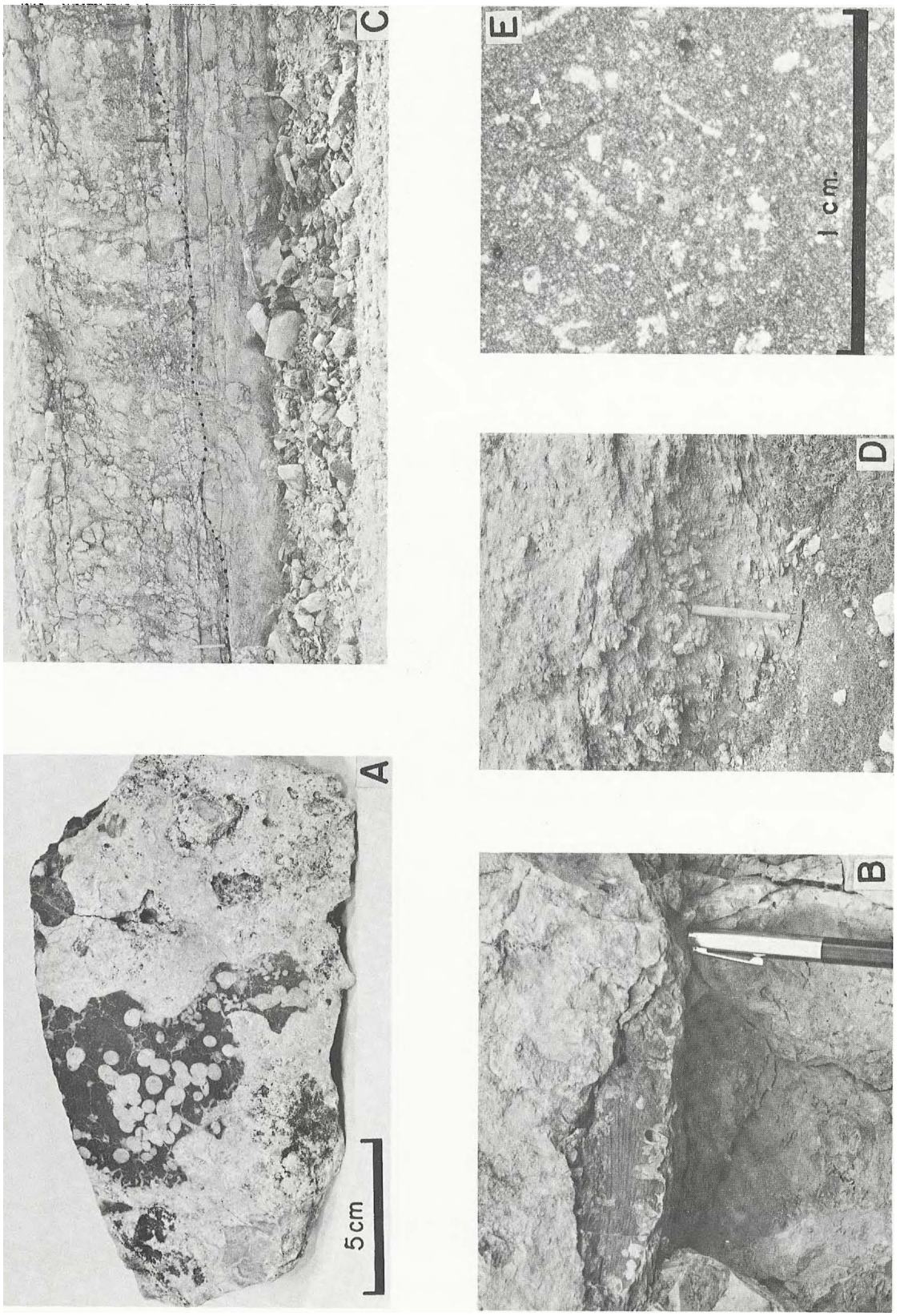

A
5cm
B
C
D
E
1 cm.

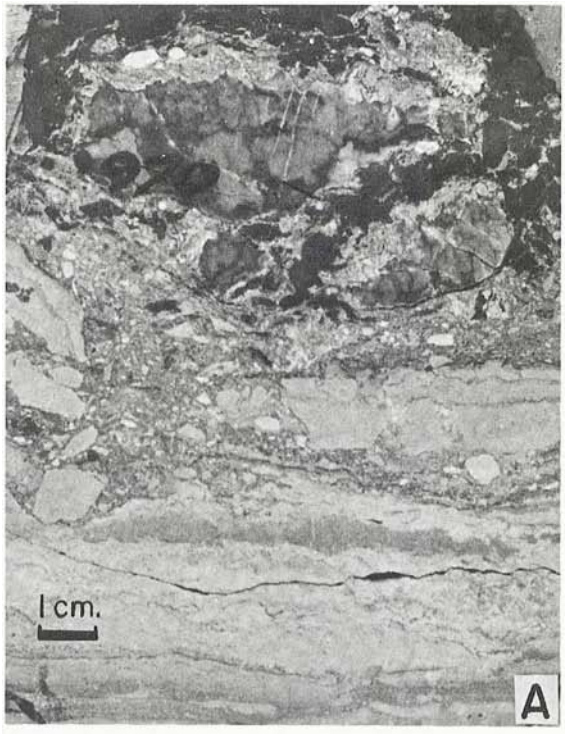
PLATE 17

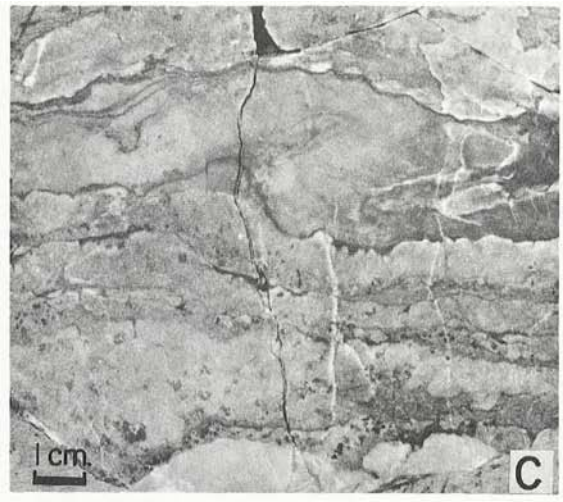
A. Core slab: supratidal stromatolitic dolomite hard crust overlain by disrupted, probable former gypsum-bearing zone; Cyclic Member of Person Formation; Tenneco No. 1 Harper, Karnes County; depth 10,970 feet. x0.8.

B. Core slab: spar-filled collapse breccia from Dolomitic Member of Kainer Formation; Southern Production Company No. 6 Jolley, Caldwell County; depth 1,439 feet. x0.9.

C. Core slab: anhydrite nodule or bed from Cyclic Member of Person Formation in the Karnes trough; anhydrite is rare in the Cyclic Member on upthrown fault blocks adjacent to the Karnes trough but more common in trough wells; Tenneco No. 1 Harper, Karnes County; depth 10,987 to 10,993 feet. x0.7.

D. Core slab: mud-filled collapse breccia characteristic of Dolomitic Member of Kainer Formation and Collapsed and Leached Members of Person Formation; Shell No. 1 Roberts, Karnes County; depth 10,734 feet. x1.7.


1 cm.
A


1 cm.
C

1 cm.
B

1 cm.
D

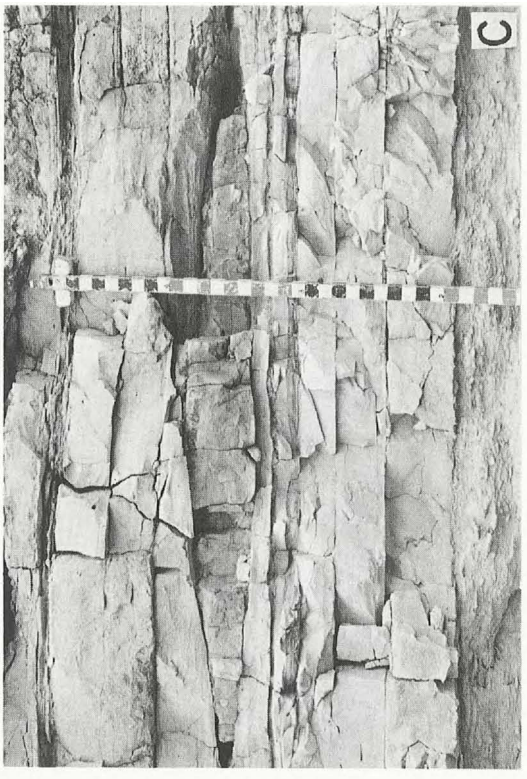
PLATE 18

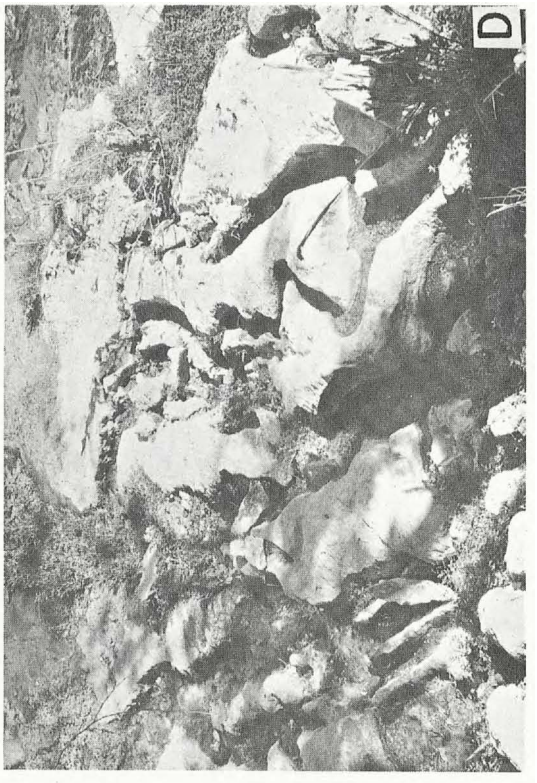
A. Collapse in upper Kirschberg. Strata behind Jacob's staff are truncated by bed about 1 foot above top of staff; some underlying beds are outlined in black for clarity; top of Kirschberg is about 5 feet above top of picture. This demonstrates some evaporite removal and collapse during Kirschberg deposition; locality 50, Kerr County.

B. Sharp contact of dolomite (gray) on limestone bed (white) in Dolomitic Member of Fort Terrett Formation at WS-171 (West Sister Creek section), Kendall County.

C. Dolomite pod in miliolid and mollusc-fragment biomicrite in Dolomitic Member of Fort Terrett Formation at J-141 (Junction section), Kimble County.

D. Sinuous, smooth-walled slots cut in massive limestone of Burrowed Member of Fort Terrett Formation by undersaturated springs at 700 Springs, headwaters of South Llano River, Edwards County.


C


D

A

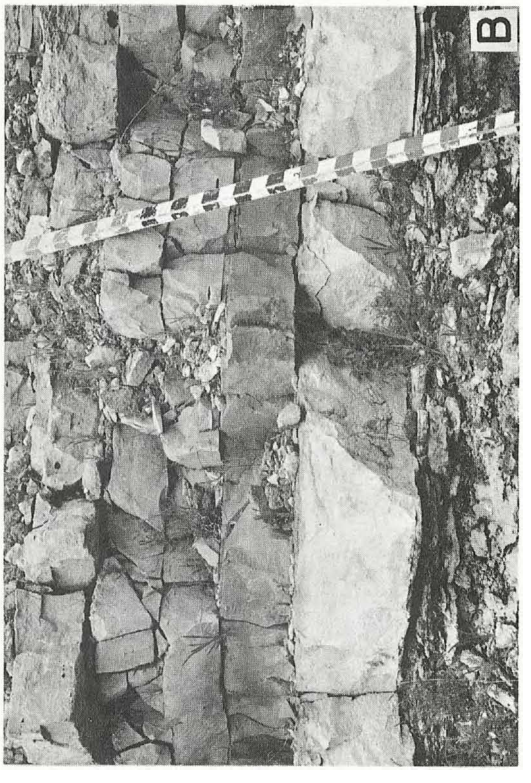

B

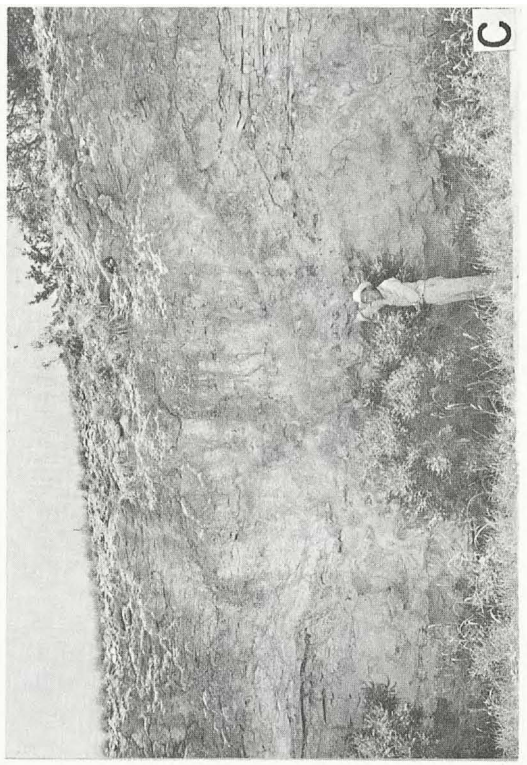
PLATE 19

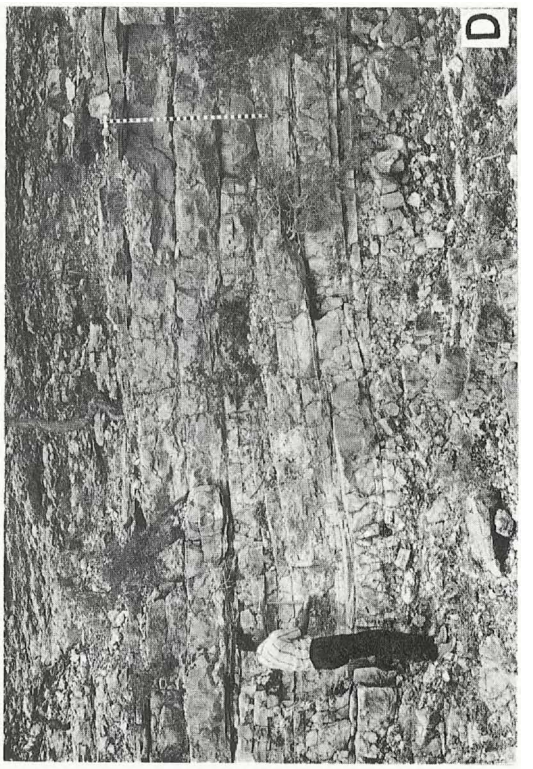
A. Laminated crystalline limestone of Kirschberg Evaporite; CS-155 (Cherry Spring section), Gillespie County.

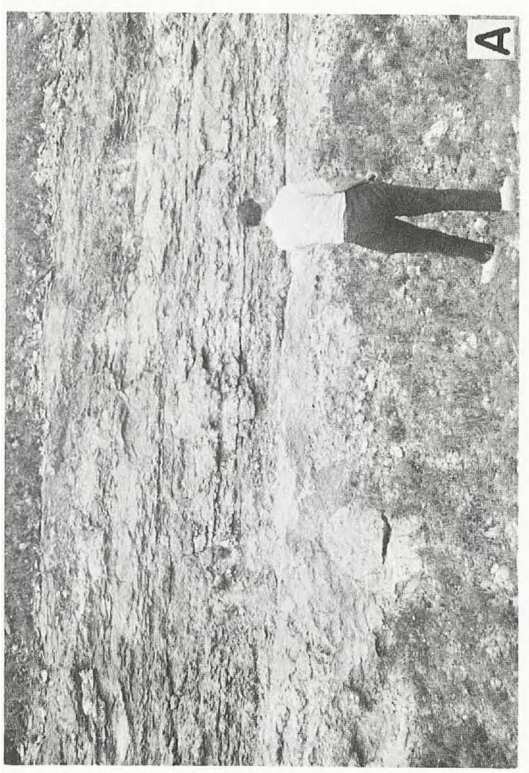
B. Tongues of fine-crystalline mollusc biomicrite extending from right to left into dolomite; thin dolomite layers pinch out against limestone tongues; layer of chert nodules marks position of limestone layer in dolomite sequence. Dolomite appears dark, limestone lighter; Vanderpool section, Bandera County.

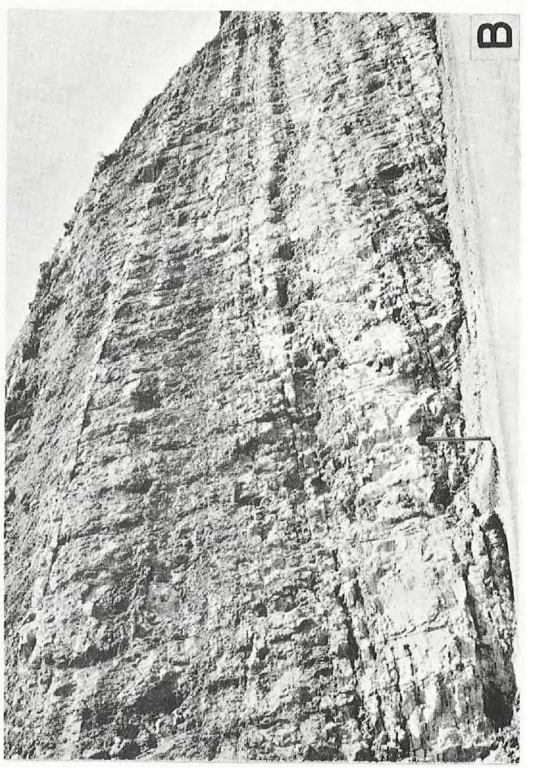
C. Collapse pipe composed of pulverulent limestone; figure points to sagging chert layer that can be traced across the pipe; road cut on old U. S. Highway 290 about 9 miles southeast of Segovia, Kimble County.

D. Collapse in upper Kirschberg. Strata between the two hands of the man on the left are truncated toward the right; the man is standing on breccia; top of Jacob's staff is top of Kirschberg. This demonstrates some evaporite removal during Kirschberg deposition; locality 38, Edwards County.


C


D


A


B

APPENDIX A—WELL INDEX

The following table shows the wells used in constructing subsurface isopachous and lithofacies maps. The wells are arranged by counties (alphabetically) and by the index number that appears on the well index map (Pl. 2). Also indicated are well elevations where known, total depth, whether samples or cores were examined, and thickness of units used in isopachous mapping. The initials "T" and "W," that appear under the column indicating sample and core examination, indicate samples or cores described by Tucker (1962a) and Winter (1961a), respectively. A blank interval indicates the unit was not drilled or logged or that the interval was not used in mapping; "f" indicates a fault in the interval; and "inc." indicates the interval was incompletely logged or drilled. "Inc." or "f" followed by a number indicates that an estimate of thickness was made based on a nearly complete penetration of the stratigraphic unit. A question mark indicates that the stratigraphic unit could not be identified in the well; a number followed by a question mark indicates a probable but not certain thickness of the unit.

Well Index No.	Operator, Well No., Fee	Elev.	Total Depth	Sample and Core Data.	Buda	Del Rio	Georgetown	Duck Creek and Kiamichi-Person	Kainer	Person -Pryor	McKnight -West Nueces	Devils River
ATASCOSA COUNTY												
1.	Barnswell, No. 1 Pfeil	502	11440	--	85	24	127	224	inc.			
2.	Gulf, No. 1 Schumann U.	479	11200	--	88	27	128	247	inc.			
3.	Gulf, No. 1 Henderson	491	11100	--	88	32	150	257	395			
4.	Marion, No. 1 Schaefer	440	--	--	114	36	190	f	f			
5.	Lone Star, No. 1-A Tom	384	13960	core	89	35	159	268	380			
6.	Smith, No. 1-A Hurt	432	10880	--	90	31	125	256	inc.			
7.	Lone Star, No. 4-A Tom	414	11050	--	94	36	142	250	370			
8.	Gilring, No. 1 Smith	381	11005	--	94	39	140	242	inc.			
9.	Phillips, No. 3 Smith Trust	409	10920	core	f	38	f	230	inc			
10.	Michelson, No. 1 Tom	--	--	--	93	32	110	inc.	--			
11.	Winn, No. 1 Tom	--	11316	--	108	35	127	237	inc.			
12.	Conoco, No. 1 Steinle	339	11618	--	103	43	f	260	382			
13.	Dougherty, No. 1 Henry	385	10522	--	98	32	122	277	inc.			
14.	Carrl, No. 1 Campbell	360	10322	spls.	102	38	124	265	inc.			
15.	Carrl, No. 1 Hickok	336	9900	--	99	38	113	inc.	--			
16.	Westland, No. 1 Smith	305	9531	spls.	101	42	112	290	inc.			
17.	Quintana, No. 4 Muil	--	9042	--	101	44	126	inc.	--			
18.	Quintana, No. 1 Muil	345	9012	spls.	102	45	120	inc.	--			
19.	Gulf, No. 6 Houston	342	9410	--	f	--	--	282	inc.			
20.	Plymouth, No. 1 Hindes	334	8818	core	107	47	111	288	inc.			
21.	Lone Star, No. 1 Ferry	419	8280	core	111	57	126	inc.	--			
22.	Humble, No. 1 Dinsmore	311	8125	spls.	f	57	137	inc.	--			
23.	Carthy, No. 1 Brite	312	8416	--	105	50	118	338	inc.			
24.	Humble, No. 1-B Courand	412	7740	--	109	56	121	inc.	inc.			
25.	Humble, No. 1 Duren and Richter	402	9390	core	108f	60	122	340	387			
26.	Stoddard, No. 1 Whitfield	433	7887	--	128	65	183	inc.	--			
27.	Newitt and Kirkwood, No. 1-A Pesek	411	8101	spls.	100	60	127	311	inc.			
28.	Humble, No. 1 Schorst	453	7405	--	109	63	120	inc.	--			
29.	Marathon, No. 3 Powell	475	7411	--	103	68	98	inc.	--			
30.	Petrocel and Hawley, No. 1 Strzelczyk	467	7507	--	116	70	124	inc.	--			
31.	Mobil, No. 4 Wallace	484	7424	--	102	70	111	355	inc.			
32.	Mobil, No. 1 Shook	492	7764	--	111	65	99	350	inc.			
33.	Sinclair, No. 1 Wilson	498	8500	--	105	65	98	340	395			
34.	Humble, No. 1 Matoscha	504	7252	--	116	70	124	inc.	--			
35.	Dillard and Waltermire, No. 1 Davies	536	7232	--	115	73	135	inc.	--			
36.	Humble, No. 46 Pruitt	477	11000	--	111	73	128	370?	380			
37.	Humble, No. 1 Pruitt	459	7069	--	109	68	112	inc.	--			
38.	Hazel, et al, No. 1 Haley	512	7480	--	114	64	103	inc.	--			
39.	Kirkwood, No. 2 Eisenhauer	529	5467	--	93	53	64	inc.	--			
40.	Walton, No. 1 Tuerpe	637	2830	--	81	64	48	inc.	--			
41.	Gorman, No. 2 Fee	--	5655	--	91	57	57	inc.	--			
42.	Arkansas Fuel, No. 1 Jasik	528	4316	--	78	55	45	inc.	--			
43.	Howell, No. 1 Jaksik	452	6621	spls.	85	55	58	285	inc.			
44.	Sorelle and Sorrelle, No. 1 Heinen	395	7264	--	99	50	86	inc.	--			
45.	Hunt Trust, No. 1 Heinen	384	7585	core	99	51	114	inc.	--			
46.	Hamon, No. 1 Marek	372	8474	--	116	51	138	347	inc.			
47.	Bailey, et al, No. 1 Schultze	454	4004	--	80	52	53	267	332			
48.	Mobil, No. 1 Dornak	463	7510	core	--	--	--	--	--			
BASTROP COUNTY												
1.	Burkhart, No. 1 Carter	540	2729	--	52	60	85	42	381			
2.	Skelly, No. 2 Bell	488	6130	--	62	60	97	47	408			
3.	General Crude, No. 1 Powell	368	3638	--	64	57	112	56	inc.			
4.	Burford, No. 1 Sanders	633	5035	--	67	59	116	50	inc.			
5.	Sunray, No. 1 Holme	--	9800	--	80	60	180	86	506			
6.	Humble, No. 1 Jones	566	9816	spls.	78	58	162	52	524			
7.	Texaco and Seaboard, No. 1 Artman	550	9260	spls.	87	58	164	50	529			
8.	Byars-Peveto, No. 1 Hill	416	7039	--	82	49	164	56	inc.			
9	DeLange and Neathery, No. 1 Urner	312	9110	spls.	83	39	162	67	538			
10.	Continental, No. 1 Malina	424	9276	spls.	84	44	150	78	512			
11.	Jackson, No. 1 Price	359	6426	--	75	48	126	58	422			
12.	Ledlow, No. 1 Alexander	490	4214	--	79	56	114	inc.	--			
13.	Carrl, No. 1 Segel	520	7016	--	82	46	108	78	448			
14.	Beckman, No. 1 Lehmann	--	3857	--	68	54	103	71	inc.			
15.	Skelly, No. 2 Ray	547	1800	--	56	56	39	102	inc.			
BEXAR COUNTY												
1.	Security, No. 2 Engleman	--	2582	--	--	--	--	203?	326?			
2.	Thomas, No. 1 Schwenn	580	4056	--	64	47	24	225	335			
3.	Fair, No. 1 Lyre	602	4607	spls.W	64	46	21	190	342			
4.	Arkansas Fuel Company, No. 1 Burkhardt	572	5099	--	69	51	28	184	340			
5.	Armstrong and Horn, No. 1 Dickey Clay	546	4007	--	--	--	--	--	--			
6.	Arnold, No. 1 Dillon	711	3369	--	78	59	37	inc.	--			
7.	H. and J. Drilling Company, No. 1 Meredith	519	2250	--	71	50	47	inc.	--			
8.	Union, No. 1 McKean	605	4425	--	68	52	35	232	321			
9.	Anderson and Prichard, No. 1 Yturri	598	4301	--	f	f	f	f	352			
10.	Pagenkopf, No. 1 Blum	713	7197	--	65	--	--	--	--			
11.	Bur-Kan, No. 1 Hubbard	703	5203	spls.W	65	56	43	264	325			
12.	U. S. Corps of Engrs., No. 1 Selma C-H	--	--	core	54	41	27	180	282			
CALDWELL COUNTY												
1.	Bender and Barnes, No. 1 Pfeiffer	--	2860	--	51	49	34	145	362			
2.	Shell, No. 1 Cayton Core-Hole	--	--	core	--	--	--	--	--			
3.	Haynes, No. 1 Braune	--	1523	--	f	f	32	126	inc.			
4.	Black, No. 1 Starcke	--	3360	spls.	52	45	37	134	f			
5.	Southern Production Company, No. 6 Jolley	--	--	core	--	--	--	130	361			
6.	Woodward, No. 1 Taylor	--	4240	--	56	48	43	125	385			
7.	Voyles, No. 1 Thomas	--	2153	--	57	57	41	inc.	--			
8.	Robbins, No. 1 Lamb	--	1939	--	54	52	40	128	inc.			
9.	Deering, No. 1 Union C. Life	--	2402	--	58	46	52	inc.	--			
10.	Sutton, No. 1 Moss	--	2897	--	60	46	43	137	inc.			
11.	Whiffen, No. 1 Jacks	--	4072	--	62	44	41	150	365			
12.	Steffenson, No. 1 Adams	--	3506	--	59	45	33	140	f			

Well Index No.	Operator, Well No., Fee	Elev.	Total Depth	Sample and Core Data	Buda	Del Rio	Georgetown	Duck Creek and Kiamichi -Person	Kainer	Person -Pryor	McKnight -West Nueces	Devils River
	CALDWELL COUNTY (Continued)											
13.	Mobil, No. 40 Mercer	--	--	core	68	44	47	162	375			
14.	Midwest, No. 1 Kreuz	--	2515	--	68	45	58	inc.	--			
15.	Brown, No. 1-A Diviney	--	2487	--	66	49	47	inc.	--			
16.	Hancock, No. 1 Corbell	--	3214	--	71	53	83	inc.	--			
17.	Rowe, No. 1 Reed Est.	610	3997	--	80	49	81	inc.	--			
18.	Holly Dev., No. 1 Williams	--	?	--	76	39	57	inc.	--			
19.	Hiawatha, No. 1 Carter	--	4769	--	72	46	56	148	411			
20.	Smith, et al, No. 1 Crowell	--	6515	--	80	41	54	152	410			
21.	Brown, No. 1 Brown	--	4833	--	78	36	50	140	f			
22.	United, No. 1 Walker	--	6946	--	82	38	59	153	405			
23.	Hunt, No. 1 Westbrook	--	5000	spls.	85	42	52	162	423			
24.	Stubbs, No. 1 Davis	456	4809	--	86	39	81	108	inc.			
25.	Rockhill, No. 1 McWhorter	--	5618	spls.T	86	41	95	97	inc.			
26.	Shell, No. 1 Thompson	610	1481	core	--	--	--	--	--			
	DEWITT COUNTY											
1.	Coastal States, No. 1 DuBose	361	12540	--	60	12	62	145	inc.			
2.	General Crude, No. 1 Mitting	476	12751	core	49	0	80	152	inc.			
	DIMITT COUNTY											
1.	Gulf, No. 1 Racine	601	9517	--	121	97	150			474	568	
2.	Deep Rock, No. 1 Barker	523	8517	--	128	142	210			210	620	
3.	Stringer, No. 1 Taylor	473	9018	--	110	108	210?			140?	620?	
4.	Texaco, No. 1 Standifer	520	8414	--	104	90	125			472?	inc.	
5.	Lightning Oil, No. 1 Silver Lake Ranches	557	9012	--	86	75	125			450?	inc.	
	FAYETTE COUNTY											
1.	Mosbacher, No. 1 Moore	400	8938	--	83	34	174	81	inc.			
2.	Sohio, No. 1 Briscoe	496	8570	--	40	13	150	86	540			
3.	Gray, No. 1 Weiting	413	11738	--	41	14	144	92	inc.			
4.	Sutton, No. 1 Psenick	301	11574	--	59	15	135	66	inc.			
5.	Mound, No. 1 Dieringer	445	12951	--	49	14	143	78	525			
6.	Hazel-Burros, No. 1 Ehler	469	11691	--	66	26	170	100	inc.			
7.	Burrow, et al, No. 1 Wehmeyer	--	12369	core	76	23	167	101	515			
8.	General American, No. 5 Standard Trust	432	9127	--	93	32	169	90	inc.			
9.	Mosbacher, No. 2 Roberts	375	8518	--	91	36	170	86	inc.			
10.	Continental, No. 1-A Cockrill	455	7697	--	90	43	145	90	inc.			
11.	Sohio, No. 1 Brown Est.	375	8181	--	96	31	155	88	inc.			
12.	Continental, No. 2 Vanklarck	456	8673	spls.T	87	42	150	76	530?			
	FRIO COUNTY											
1.	Sinclair, No. 1 Marrs-McLean	--	8803	--	103	62	106	409	inc.			
2.	Humble, No. 1 Roos	--	8600	--	100	60	108	380	inc.			
3.	Amerada, No. 1 McKinney	--	8747	--	112	70	140	450	inc.			
4.	Pan American, No. 1 Garcia	--	7504	--	104	70	f	f	410?			
5.	Socony-Mobil, No. 1 McKinley	--	11951	--	95	73	82	383	454			
6.	Amerada, No. 2 Halff and Oppenheimer	540	10050	--	105	74	101	435	413			
7	Amerada, No. 8 Halff and Oppenheimer	--	10740	spls.W	120	95	118	415	409			
8.	Katz, No. 1 Calvert	562	10999	spls.W	118	90	132	468	395			
9.	Humble, No. 1-C Marrs-McLean	632	6926	--	116	102	142	inc.	--			
10.	General Crude, No. 1 Browne	--	--	--	105	95	91			270?		
11.	Smith, No. 1 Berry	702	5163	--	99	75	81	inc.	--			
	GONZALES COUNTY											
1.	Gulf Coast Leaseholds, No. 1 Dearson Est.	487	6530	spls.	84	46	101	98	inc.			
2.	Amerada, No. 1 Henderson	310	10902	spls.	97	32	117	105	inc.			
3.	Carter, No. 1 Brubaker	403	8945	--	100	39	127	99	484			
4.	Delange, No. 1 Crozier	365	9056	--	102	31	132	inc.	--			
5.	Sun, No. 1 Dresch	329	8700	spls.	102	30	101	118	inc.			
6.	Gulf Coast Leaseholds, No. 1 Grossman	414	12268	spls.	89	21	136	130	inc.			
7.	Sinclair, No. 1 DuBose	321	11258	spls.	129	20	92	212	inc.490?			
8.	Harkins, No. 1 Kelly	287	11786	core	123	16	76	140	inc.470?			
9.	Harkins, No. 1 Zappe	252	11860	spls.	109	22	100	135	inc.			
10.	Hunt, No. 1 Stoeltje	319	10310	spls.	100	14	70	130	462			
11.	Tenneco, No. 1 Ullman	--	--	core	88	6	45	161	inc.			
12.	Brazos, No. 1 Edwards	247	11051	spls.	86	20	67	162	inc.			
13.	Hunt, No. 1 Miller	--	13356	spls.	82f	8	64	162	420			
14.	Superior, No. 1 Gardien	--	12525	spls.	87	11	96	150	inc.			
15.	Gulf Coast Leaseholds, No. 1-A Jacobs	299	11886	core	87	23	164	228	inc.			
16.	Gulf Coast Leaseholds, No. 2 Zappe	340	12525	--	92	19	198	199	inc.			
17.	O'Hornett, No. 1 Campbell-Hahn Unit	385	12184	--	58	9	86	174	inc.			
18.	Superior, No. 1 DuBose	369	12574	core	57	10	82	148	inc.405?			
19.	Mosbacher, No. 1 Frisbie	--	12975	core	76	18	180	194	f-427?			
20.	Humble, No. 1 Barnett	284	8686	--	88	19	65	inc.	--			
21.	Barnes, No. 1 Tinsley	312	7500	--	89	21	56	165	inc.			
22.	Turner, No. 1 Bouldin	384	6731	--	94	19	54	166	inc.			
23.	Dougherty, No. 2-B Manford	315	7045	--	86	21	55	inc.	--			
24.	Producers Corp. of Nevada, No. 1 Anderson	342	6223	core	98	22	64	154	inc.			
25.	Gulf Coast Leaseholds No. 1 Davenport	449	4676	--	83	30	42	170	inc.			
26.	Service, No. 1 Davis	--	4336	--	89	33	51	inc.	--			
27.	White, No. 1 Townes	441	5715	--	88	27	58	inc.	--			
28.	Rockhill, No. 1 Seekamp	384	5975	spls.	96	24	53	inc.	--			
29.	Quintana, No. 1 Spiekerman	321	12851	spls.	96	24	62	151	425			
30.	Falcon-Gulf Coast Lshlds, No. 1 DuBose	341	9266	--	98	22	80	142	inc.			
31.	C. M. and W. Drilling, No. 1 Tenberg	345	8220	--	96	23	67	148	inc.			
32.	Mobil, No. 1 Spahn	366	9000	spls.	96	24	52	161	418			
33.	Quintana, No. 1 Spahn	--	10846	core	99	26	55	166	421			
34.	Quintana, No. 1 Schnabel	--	7439	--	83	35	52	155	413			
35.	Cullen, No. 1 Lamkin	--	9177	spls.	90	37	58	144	425			
36.	Webster, No. 1 Ainsworth	--	4193	--	88	36	59	157	inc.			
37.	Gulf Coast Leaseholds, No. 1 Johnson	416	8077	spls.	86	37	62	152	436			
38.	Mobil, No. 1 Bundick	--	--	--	94	41	78	130	445			
	GUADALUPE COUNTY											
1.	Weinert, No. 1 Lehman	--	3371	--	59	44	26	162	360			
2.	Marathon, No. 1 Wilke	--	1901	--	60	42	38	inc.	--			
3.	Mobil, No. 1 Baker	--	4705	--	71	40	45	inc.	--			
4.	Diamond Half, No. 1 Bibbs	--	5509	--	f	f	f	f	--			
5.	Humble, No. 1 Baker	--	3151	--	77	42	48	193	inc.			

Well Index No.	Operator, Well No., Fee	Elev.	Total Depth	Sample and Core Data	Buda	Del Rio	Georgetown	Duck Creek and Kiamichi -Person	Kainer	Person -Pryor	McKnight -West Nueces	Devils River
	GUADALUPE COUNTY (Continued)											
6.	Gulf, No. 2 Wells	--	4305	--	81	33	42	175	inc.			
7.	Midstates, No. 1 Batey	606	3870	--	78	38	31	inc.	--			
8.	Tidewater, No. 1 Jackson	--	2810	--	70	41	30	inc.	--			
9.	Wilson, No. 1 Kubela	--	4009	--	66	44	31	189	402			
10.	Pan American, No. 1 Schmidt	--	2641	--	60	42	20	184	350			
11.	Parsons, No. 1 Tammerman	--	2958	--	53	45	23	182	341			
12.	Armstrong and Horn, No. 1 Kraft	--	1047	--	56	48	28	185	inc.			
13.	Hughes, No. 1 Zipp	--	1545	--	56	49	31	192	inc.345?			
14.	Hagen, No. 1 Calvert	--	4400	--	58	43	30	180	f			
15.	Mobil, No. 1 Pfullman	--	5146	--	65	40	35	195	378			
16.	Producers Corp., No. 1 Blume	--	2460	spls.T	65	39	29	188	inc.			
17.	Randall, No. 1 Halm	--	3662	--	72	41	31	191	380			
18.	Gulf, No. 1 Dix	--	--	--	81	39	45	179	inc.			
	HAYS COUNTY											
1.	Woodward, No. 1 Schubart	584	3338	spls.T	50	50	34	120	341			
2.	Gilliam, No. 1 Alexander	--	2028	--	48	49	43	132	333			
	KARNES COUNTY											
1.	Shell, No. 1 Jaskania	314	13685	spls.	125	31	262	233	452?			
2.	Shell, No. 1 Kainer	346	13827	--	105	27	184	236	415?			
3.	Shell, No. 2 Kainer	332	11041	core	96	27	197	225	inc.			
4.	Shell, No. 1 Kotara-Janysek Unit	347	11501	--	94	26	--	195	406			
5.	Brazos, No. 1 Person	356	11130	core	94	23	167	196	inc.			
6.	Shell, No. 1 Roberts	339	11050	core	87	18	168	229	inc.			
7.	Brazos, No. 2 Yanta	337	13688	--	112	35	230	210	449			
8.	Standard of Texas, No. 3 Yanta	309	11012	core	85	20	110	225	inc.			
9.	Shell, No. 1-A Krucjak	297	11075	core	88	23	109	220	inc.			
10.	Standard of Texas, No. 1 Wiatrek	349	11051	core	f	f	119	236	inc.			
11.	Bright-Schiff, No. 1 Crews	411	11310	spls.	98	22	75	212	inc.			
12.	Tenneco, No. 1 Wiatrek	433	11290	core	91	16	95	231	inc.			
13.	Tenneco, No. 1 Cochran	464	11465	core	90	25	77	inc.	--			
14.	Shell, No. 1 Korth	420	11698	--	75	15	95	210	inc.			
15.	Humble, No. 1 Cochran	453	11295	core	87	20	115	236	inc.			
16.	Shell, No. 1 Lyssy	404	11525	spls.	111	38	168	235?	inc.			
17.	Shell, No. 1 Hartmann	447	12468	spls.	80	24	205	236	inc.			
18.	Ada, No. 1 Nance	343	9230	core	88	17	59	177	inc.			
19.	Sun, No. 1 Patton	354	8850	core	98	21	59	198	inc.			
20.	Midwest, No. 1 L. Wagener	333	11500	--	127	39	224	288	inc.			
21.	Amerada, No. 1 Harper	330	11430	--	122	37	215	274	inc.			
22.	Tenneco, No. 1 Harper	323	11300	core	125	38	250	276	inc.			
23.	Morgan Minerals, No. 1 Pawelek	373	11220	core	105	37	200	215	inc.			
24.	Sutton, No. 1 Pawelek	359	11014	--	104	22	260	245	inc.			
25.	Standard of Texas, No. 2 Labus	361	11102	--	123	32	231	240	inc.			
26.	Shell, No. 2 Yanta	311	11200	--	82	20	101	195	inc.			
27.	Palm, No. 1 Banduch-Dragen Unit	--	11100	--	79	13	90	202	inc.			
28.	Shell, No. 1 Urbanczyk	315	11100	--	81	18	129	194	inc.			
29.	Rudman, No. 1 Banduck	345	11600	--	73	15	103	197	inc.			
30.	Shell, No. 2 Urbanczyk	294	11100	core	86	21	135	202	inc.			
31.	Texkan, No. 1 Webre	342	11300	--	118	38	260	inc.	--			
32.	Michelson, No. 1 Gawlik	316	11220	--	129	31	263	265	inc.			
33.	Standard of Texas, No. 1 Urbanczyk	346	11090	--	104	20	189	220	inc.			
34.	Continental, No. 1 Pollock	371	11005	--	86	20	139	205	inc.			
35.	Standard of Texas, No. 1 Manka Gdn. Unit 2	369	11450	--	91	24	141	204	inc.400?			
36.	Standard of Texas, No. 2 C. Pollock	317	11104	core	90	25	150	225	inc.			
37.	Mortimer, No. 1 Dzuik	296	11416	--	f	40	239	240	inc.			
38.	Seaboard, No. 1 Szalwinski	--	10800	core	121	36	221	221	f-410?			
39.	Coloma, No. 1 Dzuik	--	--	--	121	40	222	310	inc.			
40.	Humble, No. 1 Hobson Gas Unit	344	11437	--	107	32	203	248	inc.			
41.	Humble, No. 1 Pusejovsky	317	11501	--	88	27	140	233	402			
42.	Bright and Schiff, No. 1 Rohan	372	11506	core	117	38	f	f	inc.			
43.	Superior, No. 1 Pfluger	396	11610	--	112	37	231	295	inc.			
44.	Texaco, No. 5 Fertsch	411	11700	--	92	20	112	230	378			
45.	Viking, No. 1 Boehm	366	11500	--	83	17	105	224	inc.			
46.	Tenneco, No. 1 Franklin	378	11511	--	f	f	212	285	inc.			
47.	Prothro, No. 1 Stewart	465	11700	spls.	85	18	103	240	inc.			
48.	Shell, No. 1 Hysaw Gas Unit 2	--	--	core	88	20	140	inc.	--			
49.	Lone Star, No. 1 Wofford	436	12226	--	110	29	210	252	inc.			
50.	Hargrave, No. 1 Jandt	438	11320	--	109	39	216	286	inc.			
51.	Hargrave, No. 1 Thane	431	11476	--	119	30	225	inc.	--			
52.	Gulf, No. 1 Laskowski	498	11326	--	100	26	161	250	362			
53.	Christie, et al, No. 1 Weddington	513	11105	--	85	26	173	250	inc.			
54.	Christie, et al, No. 3 Weddington	500	10950	core	99	23	f	252	inc.			
	LASALLE COUNTY											
1.	Texaco, No. 1 LaSalle	--	9253	--	103	52	110	385	inc.			
2	Shipman, No. 1 Wilson	--	12508	--	100	61	125	360	?			
3.	Tidewater, No. 2 Wilson	420	12516	core	--	--	--	--	--			
4.	Mound, No. 1 Naylor-Jones	342	10550	--	83	50	98	290	410?			
5.	Gulf, No. 1 Naylor-Jones	379	10960	--	72	48	84	305	?			
6.	Gulf, No. 1 Morton Trust	415	14526	--	72	43	65	?	?			
7.	Brown, No. 1 Storey	442	10412	--	84	56	130	313	inc.510?			
8.	Humble, No. 1 Bishop	479	8783	--	106	64	112	400	inc.510?			
9.	Shell, No. 1 Matthews	493	10742	spls.W	85	73	117	456	505			
	LEE COUNTY											
1.	Skelly, No. 1 Cornell	535	6826	--	59	60	117	34	379			
2.	M. S. P., No. 1 Sanders	450	4670	--	65	58	150	33	inc.			
3.	Lockhart, No. 1 Smith	466	10015	--	73	51	192	49	450			
4.	Standard of Texas, No. 1 Biggers	463	7324	--	90	57	216	63	inc.			
5.	Holland, No. 1 Richter	400	6788	--	96	70	190	65	inc.			
6.	Seaboard, No. 1 Handrick	479	9617	--	80	59	195	80	470			
7.	Union, No. 1 Preuss	432	8246	--	85	36	192	71	575			
8.	Forest, No. 1 Durrenberger	456	10520	--	29	20	161	81	inc.			
	LIVE OAK COUNTY											
1.	Stewart, No. 1 McIlvaine	--	--	--	84	18	119	252	inc.365?			
	MCMULLEN COUNTY											
1.	Bridwell, No. 1-E New	--	11368	spls.	75	f	42	208	inc.			
2.	Tenneco, No. 1-A Jambers	--	--	core	87	18	65	214	inc.			
3.	Continental, No. 1 Horton	304	12129	--	92	14	65	220	inc.			

Well Index No.	Operator, Well No., Fee	Elev.	Total Depth	Sample and Core Data	Buda	Del Rio	Georgetown	Duck Creek and Kiamichi -Person	Kainer	Person -Pryor	McKnight -West Nueces	Devils River
	MCMULLEN COUNTY (Continued)											
4.	Humble, No. 1-C Gubbels	--	11314	--	95	26	110	200	395?			
5.	Humble, No. 1 Wheeler	--	10407	--	--	28	95	176	395?			
6.	Weigand, No. 1 Perry	--	--	--	96	40	119	278	inc.			
7.	Pan American, No. 1 Franklin	--	--	--	92	41	105	294	inc.			
8.	Maguire, No. 1 Franklin	--	10502	--	90	45	97	330	inc.			
9.	Fasken No. 1 Henry	297	11333	--	83	42	79	270	inc.			
10.	Humble, No. 2 Dilworth	334	11471	--	88	42	31	228	425?			
11.	Fasken, No. 1 Dilworth	286	11425	--	88	38	95	242	inc.			
12.	Pan American, No. 1 Henry	--	14046	--	78	28	62	222	inc.			
	MEDINA COUNTY											
1.	Samuels, No. 1 Fee (WW)	--	--	--	76	67	43			inc.	--	inc.
2.	Snowden, No. 1 Haegelin	944	4836	spls.W	88	74	75			?	?	640
3.	Ford, No. 1 Raybourn	911	1995	--	83	74	43			?	--	inc.
4.	Ford, No. 1 Nunley	905	5033	--	88	82	67			?	?	720
5.	Glasscock, No. 1 Carle Merc.	764	2412	--	87	80	48			?	--	inc.
6.	Humble, No. 1 Wilson	676	2662	--	88	84	70			323?	403?	726
7.	Pan American, No. 1 Muennink	755	4958	--	88	76	72			?	?	705
8.	Fair, No. 1 McAnelly	717	5515	--	84	70	61			--	--	620
9.	Progress, No. 1 Bendele	306	3700	--	90	71	58			267?	370?	637
10.	Parker, No. 1-A Fee	--	2500	--	71	59	40			inc.	--	--
11.	Lewis, No. 1 Blatz	621	3238	--	88	64	45			inc.	--	--
	MILAM COUNTY											
1.	Harrison, No. 1 Smith	452	4560	--	58	61	110	30	367			
2.	Harrison, No. 1 Schram	444	5220	--	79	60	110	27	390			
3.	Johnson, No. 1 Swope	--	4374	--	78	43	--	--	--			
4.	General Crude, No. 1 Perry	540	9648	--	83	43	182	66	465			
	TRAVIS COUNTY											
1.	Brewster and Bartle, No. 1 Tucker	--	4606	--	43	67	75	45	358			
2.	Floyd, No. 1 Castleman Est.	600	1758	--	46	68	90	46	inc.			
3.	Goff, No. 1 Burleson	427	1875	--	47	59	71	42	351			
4	Reasor, No. 1 Ezell	519	3312	--	46	57	61	66	310			
5.	Woodward, No. 1 Nelson	--	--	spls.T	48	52	49	103	351			
	UVALDE COUNTY											
1.	Shell Dev. Co., No. 1 Pardi	--	--	core	--	--	75			297	338	--
2.	U.S.G.S., No. 1 Nelson	942	1279	--	97	95	115			290	inc.	--
3.	Pan American, No 1 Smythe	875	3686	--	105	120	232			267	365	--
4.	Howeth, No. 1 Winslow	919	3688	--	93	97	35?			--	--	620
5.	Steeger, No. 2 Kincaid	888	4000	--	75	84	73			256?	480	--
6.	Steeger, No. 1 Kincaid	857	4015	--	80	92	83			--	--	718
7.	Howeth, No. 1 Kincaid	731	5622	--	90	68	61			f	f	?
8.	Gorman, No. 11 Woodley Ranch "B"	859	4800	--	75	82	55			--	--	750
9.	Gorman, No. 2 Woodley Ranch	757	3694	--	68	88	63			--	--	742
10.	Bennett and Sorrell, No. 1 Rehm	835	4505	--	--	--	--			--	--	--
	WILLIAMSON COUNTY											
1.	City of Georgetown, No. 1 Fee (WW)	750	1820	--	--	--	--	--	327			
2.	Henna, No. 2 Alsabrook	759	2331	--	--	--	--	--	328			
3.	Jarrell, No. 1 Avery	653	2956	--	37	70	75	22	346?			
4.	Jarrell, No. 1 Coupland	554	3571	--	41	69	79	37	349			
5.	City of Taylor, No. 1 Fee (WW)	557	3333	--	40	68	79	32	356			
6.	Puma, No. 1 Simcik	495	2125	--	38	69	86	22	358			
7.	Bristow, No. 2 Herndon	569	1758	--	31	61	76	23	368			
	WILSON COUNTY											
1.	Sun, No. 2 Bain	553	4625	core	81	39	45	inc.	--			
2.	Sun, No. 1 Bain	515	4600	spls.	--	36	48	inc.	--			
3.	Cullen, No. 1-A Moore	--	9176	spls.	91	29	57	164	f-392			
4.	Maryland, No. 1 Rice	449	5610	spls.	96	25	53	inc.	--			
5.	Eddy, No. 1 Cone	519	5265	--	85	37	43	inc.	--			
6.	Fair and McFarland, No. 1 Teague	471	7494	--	82	41	41	242	420			
7.	Sunray, No. 1 Donaho	--	7510	spls.	83	39	40	f	f			
8.	Wilson, No. 1 Foerster	600	3730	--	76	47	41	inc.	--			
9.	Hughes, No. 3 Scull	512	3232	--	75	40	47	inc.	--			
10.	Reasor, No. 1 Hargrove	556	2366	--	75	48	19	inc.	--			
11.	Goetz, No. 1 Powell	688	3185	--	72	49	34	inc.	--			
12.	General Crude, No. 1 Trevino	472	6422	--	73	51	37	256	348			
13.	Gorman and Delange, No. 1 McKenzie	535	5212	spls.	80	50	50	262	inc.			
14.	Sinnod, No. 1 Warren	476	6165	--	88	47	52	inc.	--			
15.	Henshaw, No. 1 Ewing	458	6487	--	87	42	50	227	inc.			
16.	Mosser, No. 1 Remschel	--	8050	--	108	40	74	inc.	--			
17.	Exeter, No. 1 Kruse	--	6824	--	92	34	54	217	inc.			
18.	Andrade, No. 1 Kopecki	--	6355	spls.	94	32	51	inc.	--			
19.	Pan American, No. 1 Laskowski	407	7036	core	92	29	72	inc.	--			
20.	Hewitt-Dougherty, No. 1 Manford	420	7300	core	92	25	59	180	inc.			
21.	Thomas, No. 1 Kotara	422	8510	--	98	28	69	203	inc.			
	ZAVALA COUNTY											
1.	Park and Phillips, No. 1 Flowers and Ward	826	7290	--	113	156	248			290	364	--
2.	Phillips, No. 1 Zavala	723	7515	--	117	187	328			275	380	--
3.	Adams and Lyles, No. 9 Matthews	784	4363	--	115	157	267			310	478	--
4.	Bowman, No. 1 Niemeyer	741	3875	--	111	129	204			313	inc.	--
5.	Jergens, No. 1 Pryor	787	3546	--	100	106	107			--	--	828
6.	Bluebonnet, No. 1 Kincaid	--	5032	--	92	88	67			--	--	800
7.	Bankhead, No. 2 Alley	745	3865	--	103	96	85			inc.	--	--
8.	Wann, No. 1 Brubeck	--	5124	--	110	112	129			inc.	--	--
9.	Lipan, No. 2 Bartlett	737	5886	--	115	134	186			272?	--	750
10.	Humble, No. 2 Pryor	690	8686	coreW	122	171	235			248	488	--
11.	Ring, No. 2 Matthews	732	6230	--	138	185	358			232	inc.	--
12.	Humble, No. 1 Wolf	639	6890	--	150	200	300			205	485?	--
13.	Texaco, No. 3 N. E. Farming Co.	631	10400	--	157	199	333?			282	495	--
14.	Rockhill, No. 1 Holdsworth	713	7253	--	128	131	165			--	--	inc.
15.	Phillips, No. 1 Glasscock	698	7358	--	118	120	143			--	--	inc.
16.	Weir, No. 21-A Denman-Lackey	--	--	--	165	182	302?			276	582	--

APPENDIX B—CORE DESCRIPTIONS

Descriptions of cores from 33 wells are given on the following pages. The wells are listed in order of county, fee, and operator and are located by field or survey. Stratigraphic units cored and described include Buda Limestone, Del Rio Clay, Georgetown Formation, Edwards Group (Person and Kainer Formations), and Glen Rose Formation. Most are long, continuous cores that were slabbed and reassembled prior to examination. Selected core slabs have been placed in collections of the Department of Geological Sciences, The University of Texas at Austin. Two of the cores, Standard of Texas No. 1 Wiatrek and Shell No. 2 Kainer, have been placed on permanent open file in the sample warehouse of the Shell Oil Company, Houston, Texas, as type sections of the Person and Kainer Formations, respectively.

The reader is reminded that cores are traditionally described from the top down, whereas measured sections are described from the base up.

Fifteen other cored wells are shown on the index map (Pl. 2) but descriptions of these are not included, for a variety of reasons: (1) They are described and published elsewhere in the literature; (2) only a few core-chips were available; (3) cores were unmarked or poorly marked.

Such core data were utilized in constructing lithofacies maps (fig. 35, A-J); the wells concerned are:

ATASCOSA COUNTY—
- Humble No. 1 Duren-Richter
- Lone Star No. 1 Ferry
- Hunt Trust No. 1 Heinen
- Plymouth No. 1 Hindes

DeWITT COUNTY—
- General Crude No. 1 Mitting

GONZALES COUNTY—
- Producers Corp. of Nevada No. 1 Anderson
- Quintana No. 1 Spahn

KARNES COUNTY—
- Ada No. 1 Nance
- Sun No. 1 Patton
- Bright and Schiff No. 1 Rohan
- Standard of Texas No. 1 G. Yanta

UVALDE COUNTY—
- Shell Development Co. No. 1 Pardi Core-Hole

WILSON COUNTY—
- Pan American No. 1 Laskowski
- Hewitt and Dougherty No. 1 Manford

ZAVALA COUNTY—
- Humble No. 2 Pryor

Depth (feet)		Thickness (feet)
	ATASCOSA COUNTY; MOBIL, NO. 1 DORNAK (48); JOURDANTON FIELD	
	GEORGETOWN FORMATION	
7260-7291	1. Limestone: light- to medium-gray, wispy, burrowed, argillaceous micrite and mollusc biomicrite; IA, intensely burrowed in part, with black, carbonaceous wispy streaks	31
7291-7297	2. Limestone: very light brownish-gray, granular, microsparite, IIIA/B, note scattered small mollusc shells -- at 7292.5 - spar-filled cracks, also black carbonaceous streak -- cave? -- at 7294.5 - definite cave filled with Georgetown carbonaceous shale and Georgetown pebbles -- at 7297 - boring	
7297-7303	3. Limestone: light brownish-gray, fine-grain skeletal and Globigerina, with carbonaceous wispy streaks -- at 7298.5 - large cave filled with dark-gray medium-grain dolomite -- at 7302 - black streak -- at 7303 - abundant Globigerina, weathered 1" Georgetown pebbles, very sharp contact below	6
	EDWARDS GROUP PERSON FORMATION	
7303-7305	4. Limestone: light brown, dense, fine-grain miliolid wackestone; IA, possible burrowing, upper contact shows termination of spar-filled vertical fracture; another dark carbonaceous spar-filled cave, very large, at 7304.5 Remarks: a. Georgetown appears to represent shallower marine deposition than in Karnes County cores. b. Sequence of caves, apparently in Georgetown, suggest repeated supermarine exposure; reworked and discolored Georgetown clasts in basal Georgetown in Karnes County are in harmony with this interpretation.	2
	ATASCOSA COUNTY; PHILLIPS, NO. 3 SMITH TRUST (9); FASHING FIELD	
	EDWARDS GROUP PERSON FORMATION	
10720-10780	1. Limestone: medium brownish-gray to dark-brown, very fine- to medium-grain, burrowed, miliolid and pellet biomicrosparite with scattered Toucasia and large, leached, spar-replaced rudist shells; IIIA/B, very coarse-grain rudist biosparite with scattered bluish-white chert in middle part of unit	60
	ATASCOSA COUNTY; LONE STAR, NO. 1-A TOM (7), FASHING FIELD	
	GEORGETOWN FORMATION	
10235-10240	1. Limestone: medium- to dark-gray, dense, argillaceous, wispy, pyritic calcisphere and Globigerina biomicrite, IA, few pellets of glauconite; lower contact not present in core	5
	EDWARDS GROUP PERSON FORMATION Cyclic Member--	
10240-10270	2. Limestone: medium-brown, poorly sorted, dense Toucasia and miliolid biomicrite and muddy biosparite; IA; dense, unaltered mud in upper 2' changes to microsparite below; shells occur generally whole or as large fragments, miliolids much less abundant from 10245 down. -- at 10249 - rock becomes slightly darker -- at 10251 - large shells drop out -- mostly fine skeletal biomicrite, many fragments unidentifiable, in lower part have "wormy" look -- at 10254.5-55 - beautiful stromatolite-limestone, not dolomite -- at 10255 - back to Toucasia and oyster microsparite of above; medium-brown, somewhat rotten (IIIA/B?) -- at 10257-58 - homogeneous, evenly laminated, pelletal micrite, not microspar -- at 10258-60 - back to medium-brown, dense, miliolid and Toucasia muddy biosparite -- at 10260-61 - thin zone of undulose laminations with soft-clasts interbedded -- does this represent a soft-collapse? -- at 10261-62 - fine-grain miliolid and pellet biomicrosparite -- at 10262 - Toucasia; also white chert replacement of shells -- at 10265-66 - Cladophyllia numerous -- at 10268 - begin to pick up oysters, small caprinids, Chondrodonta -- at 10270 - two gray-brown fossiliferous chert nodules	30
10270-10285	3. Gap	15
10285-10315	4. Limestone: medium-brown, pellet and Toucasia biomicrite; I/IIIA; probably intensely burrowed to be so mixed up; no bedding or orientation; somewhat oil-stained; no large shells -- mostly fragments -- at 10289 - probable pisoliths (about 1" across), irregular, not too spherical -- rather oblong, also note druse -- at 10292 - brown chert nodule apparently replaced rudist limestone -- at 10293-96 - large Chondrodonta shells in pellet and shell biosparite matrix -- at 10296 - pellet and Toucasia biomicrosparite, with abundant oil stain -- at 10299-305 - Pellet and fine-skeletal dolomitized biomicrite without Toucasia; pellets and grains leached away; IIIB -- at 10303 - non-dolomitic matrix with dolomitic rounded clasts and burrows; note vertical fractures 1/4-1/2" wide here filled with sparry calcite -- at 10305 - burrowed -- at 10309 - gray chert nodules -- at 10312 - large patches of sparry calcite -- probably filling leached large shells	30
10315-10348	5. Limestone: medium-brown, fine-grain, well-sorted mollusc-fragment biomicrosparite; IIIA/B; few large shells -- at 10321 - few large Toucasia fragments, also caprinids (not massive shells) scattered throughout -- at 10331 - six inch black chert nodule; large shells much less common below 10331 -- at 10339-44 - medium-brown, wispy interval, good pelletal and mollusc-fragment biosparite; dark-brown at top -- at 10344-48 - becomes coarse- to medium-grain biosparite, good porosity in upper 1 foot, becomes abruptly finer from 10346.5 down; abundant white chert grains	33
10348-10352.5	6. Limestone: dark-brown, dense, burrowed micrite; IA; very carbonaceous at top, slightly dolomitic from 10349-50, small oyster shells at 10351. -- at 10352 - spar-filled cracks in breccia overlain by oyster biomicrite, indicating early cementation and erosion	4.5
10352.5-10365	Marine Member--	
10352.5-10365	7. Limestone: medium- to dark-brown Toucasia and pellet biomicrosparite; IIIA; much shell material apparently leached away, filled in with spar	12.5
10365-10385	8. Gap	20
10385-10409	9. Limestone: medium-brown, wispy, whole-mollusc biosparite; IIIA; fossils are leached rudists, become larger, more abundant downward. -- at 10400-06 - matrix becomes coarse grain, shells large, some scattered IIID porosity -- at 10407 - fine-crystalline dolomite in burrows -- all rock below this level dolomitic to some extent; becomes less shelly, more burrowed and homogeneous downward	24
	Leached Member--	
10409-10444	10. Calcitic dolomite: medium-brown, fine-crystalline, essentially featureless, burrowed dolomitized micrite; IIIA/B. -- at 10412-22 - Gap -- at 10422 - large (1"-2") irregular patches of sparry calcite -- at 10423-24 - small (2") incipient collapse -- at 10424 - becomes dull brownish-gray -- at 10425-26 - note 4 large calcite-replaced anhydrite nodules with oil stain immediately around peripheries -- at 10426-28.5 - collapse with white spar filling-in where anhydrite was and where cracks resulting from collapse were -- at 10428.5 - becomes less porous (IIIA/B), burrowed, well sorted, fine grain, dolomitized mollusc-fragment biomicrite; few oyster shells -- at 10435-38 - calcite patches, incipient collapsing, small veins; distinct collapse in bottom 1 foot -- at 10438-42 - Gap -- at 10442-44 - dark-brown, severely burrowed, grading to unit below	35
	Collapsed Member--	
10444-10447	11. Dolomitic limestone: medium-brown, very coarse-grain, poorly-sorted, angular clast intrasparite; IIIA/B; several different grades of dolomite in clasts, including a distinct stromatolitic interval at 10445-47; becomes more collapsed and angular, with sparry calcite below	3

Depth (feet)		Thickness (feet)
10447-10452	12. Dolomitic limestone: medium grayish-brown, leached mollusc-shell and pellet biomicrite; IIIA/B, distinct current laminations at 10450-51	5
10452-10453	13. Dolomite: medium gray, thoroughly-leached dolomitized mollusc biomicrite; IIIC	1
10453-10470	14. Gap	17
10470-10482	15. Dolomite: medium grayish-brown, homogeneous, massive, burrowed dolomitized micrite; IIIA/B; in top foot note oysters, scattered dolomite rhombs in microspar matrix -- at 10475-77 - becomes dark-gray, with distinct vertical spar-filled cracks -- at 10477-78 - stromatolite crust -- at 10478-81 - burrowed, with few vertical cracks -- at 10481-82 - stromatolite with calcite pseudomorph after anhydrite nodule	12
10482-10491	16. Gap	9
10491-10497.5	17. Limestone: medium- to light-brown, fine- to medium-grain, well-sorted, soft-pellet and mollusc-fragment biomicrosparite; IIIA/B, few miliolids, intraclasts; whole Toucasia at 10491-94	6.5
	Regional Dense Member--	
10497.5-10511	18. Limestone: dark-gray, dense, intensely burrowed, wispy, argillaceous, pyritic, mollusc micrite and biomicrite; IA; shells are mostly fragile molluscs; very carbonaceous toward bottom -- intact contact not present but apparently sharp	13.5
	KAINER FORMATION	
	Grainstone Member--	
10511-10525	19. Limestone: light to medium grayish-brown, well-sorted, fine- to medium-grain, miliolid and mollusc biomicrosparite; IIIA; note 1-foot interval of dark-brown, dense, pellet micrite at 10513; intensely burrowed at 10516 and below; also darker and more dense below 10522	14
10525-10541	20. Gap	16
10541-10543	21. Limestone: medium-brown to dark-gray, miliolid biosparite and dolomitic intramicrite; IIIA; clasts are small rounded pellets and intraclasts	2
10543-10558	22. Gap	15
10558-10590	23. Limestone: medium-brown, well-sorted, fine- to medium-grain miliolid and pellet biosparite and biomicrosparite; IIIA/B; note also other forams, broken shell fragments but no large shells; notice many grains are coated -- pseudooliths(?). -- at 10562 - fantastic storm layer 2" thick with large distinct mudcracks -- at 10566-68 - dense muddy streaks -- at 10566, 69, 82, 86, 89 - wispy intervals -- at 10582-85 - slightly dolomitic	32
10590-10608	24. Gap	18
	Dolomitic Member--	
10608-10613	25. Calcitic dolomite: medium-brown, fine-crystalline, cyclic dolomite sequence; IIIB mostly, sequence as follows: -- 10608-11 - burrowed medium- to fine-grain, dolomitized mollusc-fragment muddy biosparite -- at 10611-12 - dolomitized collapse with spar filling voids and probably replacing anhydrite as well -- at 10612-13 - breccia with various kinds of pebbles in dolomite silt matrix	5
10613-10628	26. Dolomitic limestone: medium-brown, fine-crystalline, cyclic dolomite sequence; IIIA mostly; sequence as follows: -- at 10613-18 - burrowed miliolid biomicrosparite -- at 10618 - calcite-replaced anhydrite nodules, incipient collapsing, some burrowing -- at 10623 - good wispy sequence here, still same matrix but fine-grain -- at 10625-628 - Gap	15
10628-10636	27. Dolomitic limestone: medium-brown, homogeneous, medium- to fine-grain, fairly well-sorted, pellet, miliolid and mollusc-fragment biosparite; I/IIIA/B; many grains are coated; sequence terminates abruptly	8
10636-10648	28. Dolomite: medium-gray, massive, intensely burrowed, very fine-grain, dolomitized, mollusc-fragment and pellet, muddy biosparite; IIIB and IIIC; sequence capped by superb 1-foot stromatolite-collapse sequence; excellent porosity at 10638-40 and 10643-45; core at 10640 shows truncated spar-filled fracture	12
10648-10658	29. Gap	10
10658-10672	30. Calcitic dolomite: medium-brown, fine-to medium-grain, moderately-sorted, dolomitized and recrystallized miliolid and oyster biosparite and biomicrosparite; I/IIIA (microspar) and IIIB (dolomite); sequence capped by stylolite; some burrowing in upper 2 feet; note 2-foot interval of white, rather porous agglomerate of crystalline celestite at 10,660-62, more dolomitic below 10,664, also burrowed, still with scattered oysters; note fairly coarse dolomite breccia at 10,671, with 4-5 different kinds of pebbles, all dolomitized to different degrees	14
10672-10678	31. Gap	6
10678-10682	32. Dolomitic limestone: medium-brown, fine- to coarse-grain, moderately-sorted, mollusc-fragment biomicrosparite; IIIA mostly (microspar); brown chert nodule at 10678-79; lower boundary transitional	4
10682-10687	33. Dolomite: medium-gray dolomitized stromatolitic collapse breccia, IIIB, stromatolites look like they were soft; unit grades as follows: -- at 10685-86 - grades to massive celestite, apparently replacing nodular anhydrite, for original anhydrite texture still clearly present	5
10687-10698	34. Dolomitic limestone: medium to dark grayish-brown, moderately-sorted, coarse- to fine-grain dolomitic mollusc-fragment intrasparite; IIIA/B; becomes darker, finer grain, more dolomitic downward. -- at 10690 - very coarse intrasparite with large, rounded, coated agglomerate clasts, shell fragments, pseudooliths -- at 10691 - current streaks -- at 10697-98 - rock at bottom is pure dolomite	11
10698-10708	35. Gap	10
10708-10712	36. Dolomite: medium gray, massive, very fine-crystalline, dense dolomitized micrite; IIIA; spar- and anhydrite-filled vertical cracks at 10708-09; few leached shelly zones at 10709-10; laminated (not stromatolitic) at 10711-712	4
10712-10719	37. Dolomitic limestone: light to medium grayish-brown, thoroughly burrowed, dolomitic, fine grain, mollusc-fragment micrite and biomicrite; IIIA/B; burrows are filled with coarse-crystalline calcitic dolomite	7
10719-10761	38. Dolomitic limestone: medium to dark brownish-gray, massive, medium-grain, moderately-sorted, dolomitic, mollusc-fragment, clast, and miliolid biosparite; IIIA/B; current streaks at 10723-25; becomes finer, more dolomitic downward to 10726. -- at 10719-21 - less dolomitic, note Dictyoconus at 10720 -- at 10721-26 - grades to calcitic dolomite -- at 10726-28 - Gap -- at 10728-30 - less dolomitic, much coarser; note common coated grains -- at 10730 - grades to dark-brown, fine-grain, massive, dense, mollusc-fragment biomicrite -- at 10735 - very coarse-grain, coated aggregate clasts of miliolid packstone, also corals; good III/B porosity; non-dolomitic -- at 10737 - unit of above becomes dark brownish-gray, finer grain, dolomitic -- at 10743 - vertical fractures filled with spar -- at 10746-58 - Gap -- at 10758-61 - dark-brown, miliolid and mollusc-fragment biomicrite; horizontal current laminations	42
10761-10775	39. Dolomitic limestone: medium to dark brownish-gray, coarse-grain, moderately-sorted, dolomitic, mollusc-fragment intrasparite; IIIA and IIID; molluscs are oysters and Toucasia; heavily oil-stained; distinct collapse at 10764-69. -- at 10773 - becomes essentially unfossiliferous, more dolomitic, darker and finer grain, terminates in stromatolite collapse one foot thick	14
10775-10778	40. Gap	3
10778-10791	41. Dolomitic limestone: medium to dark grayish-brown, coarse- to medium-grain, moderately sorted, dolomitic, mollusc-fragment and miliolid biosparite IA and I/IIIA/B; pure limestone, no microspar; highly burrowed from 10780-91 with dolomite concentrated in burrows; some grains coated	13
10791-10795	42. Dolomite: dark to medium brownish-gray, massive, burrowed dolomitized micrite, IIIA	4
10795-10808	43. Gap	13
10808-10824	44. Dolomitic limestone: medium to dark-brown, poorly-sorted, dolomitic, whole-mollusc, miliolid and clast biosparite, IIIA/B, whole shells include oysters, gastropods, Toucasia, caprinids, minor changes as noted: -- at 10810-11 - anhydrite nodules replaced in part by calcite; calcitic dolomite matrix -- at 10812-14 - current laminations -- at 10815-17 - becomes medium brown, only slightly dolomitic -- at 10817-20 - as above, becomes calcitic dolomite, very porous -- at 10824 - sequence terminates with 2 large (7") calcite-anhydrite-filled cavities	16
10824-10832.5	45. Dolomite: medium to dark-gray, massive, essentially featureless, medium-crystalline dolomitized micrite or very fine-grain biomicrite, IIIA; rather dense, with scattered patches of calcite-anhydrite; sequence terminates in 1" hard crust, partly collapsed	8.5
10832.5-10845	46. Dolomitic limestone: essentially a repeat of 10808-24, with following minor features: -- at 10836-37 - large distinct anhydrite nodules up to 4" across -- at 10839-45 - shells somewhat fewer	12.5

Depth (feet)		Thickness (feet)
10845-10857	47. Gap	12
10857-10888	48. Dolomitic limestone: medium to dark grayish-brown, wispy, poorly-sorted, generally medium- to fine-grain, dolomitic mollusc-fragment and miliolid biosparite, IIIA/B. -- at 10857, 10863 - calcite-anhydrite nodule -- at 10857-71 - scattered small oysters -- at 10800, 10881, 10884, 10887 - white anhydrite nodules up to 2" across	31
10888-10907	49. Gap	19
	GLEN ROSE FORMATION	
10907-10910	50. Dolomitic limestone: medium-brown, medium-grain, well-sorted, dolomitic miliolid and mollusc-fragment biosparite, IA; current laminations; some round dolomite clasts 1/2 to 1" across; many grains are coated; dolomite crystals occur as evenly distributed, fairly coarse rhombs, lower boundary a stylolite	3
10910-10919	51. Dolomite: medium-gray, dense, massive, medium-crystalline dolomite; IIIA; apparently burrowed -- very little of original texture is discernible; note common large (2"-3") scattered white anhydrite nodules	5
10919-10963	53. Calcitic dolomite: medium- to dark-gray, massive, dense, fine- to medium-crystalline, burrowed dolomite; IIIA; no large shells -- rock was apparently homogeneous micrite or fine-grain biomicrite throughout, anhydrite nodules occur about every foot. -- at 10927-42 - Gap -- at 10950 - fine current laminations, wispy structures with few thin streaks of miliolid biosparite, anhydrite continues, less dolomitic	44
10963-10982	54. Limestone: medium brownish-gray, fine- to medium-grain, miliolid biosparite, other features: -- at 10966-74 - wispy structures -- at 10970-74 - few rudists -- at 10974-82 - as above, but wispies gone	19
	Remarks: a. Cyclic Member of Person Formation is much less dolomitic than to the northeast at Person Field. b. Abundant anhydrite in nodules in the Dolomitic Bed of the Kainer Member.	
	BEXAR COUNTY; U.S. CORPS OF ENGINEERS, NO. 1 SELMA CORE-HOLE (12); 1 MILE NW OF SELMA, TEXAS	
	GEORGETOWN FORMATION	
238.8-246	1. Limestone: medium bluish-gray to light yellowish-cream, wispy, punky, argillaceous, whole-mollusc biomicrite; common Gryphaea, Exogyra, snails, pectens in matrix of fine-grain, mollusc-fragment biomicrite, rock above 242.6 is gray, rock below is cream; lower contact not present, apparently abrupt	7.8
	EDWARDS GROUP	
	PERSON FORMATION	
246-268	2. Limestone: light yellowish-cream to grayish-white, porous, very poorly sorted, fine- to very coarse-grain, caprinid biosparite; other features: -- at 246-48 - dense, light grayish, miliolid and mollusc-fragment biomicrite -- at 254-56 - coarse-grain, rounded shell fragments -- at 256-57 - Chondrodonta -- at 263-68 - gradually becomes finer grain downward, more punky and softer, less shelly, grades into underlying unit	22
268-280	3. Limestone: light-cream to grayish-white, punky, massive, very fine- to fine-grain biomicrite and micrite; porous and slightly altered, slightly recrystallized at base; large whole oysters (Gryphaea) in burrowed matrix at 277-78	12
280-299	4. Limestone: light yellowish-gray, fine- to very fine-grain, mollusc-fragment and miliolid biomicrite; slightly and finely recrystallized and porous from 280-87; other features: -- at 288, 295 - Toucasia -- at 290 - chert nodules -- at 295-99 - no recovery	19
299-316	5. Limestone: light grayish-brown, fine- to medium-grain, moderately-sorted, miliolid and mollusc-fragment biosparite and biomicrite; miliolids predominate; other features: -- at 299-302 - muddy, pitted texture produced by leaching skeletal grains from muddy patches, finely recrystallized in patches -- at 302-04 - interbedded micrite and miliolid biosparite -- at 305-07 - recrystallized, honeycombed limestone -- at 312-16 - whole Toucasia in biomicrite matrix	17
316-332.5	6. Crystalline limestone: light grayish-brown, honeycombed, very porous, fine- to medium-crystalline limestone and massive calcite; other features: -- at 317, 325 - light grayish-brown chert nodules -- at 318-26, 327-32.5 - no recovery -- driller reported honeycomb rock	16.5
332.5-337	7. Limestone: light-gray, fine-grain, miliolid and mollusc-fragment biomicrite	4.5
337-358.5	8. Dolomitic limestone: light- to medium-brown, porous, fine-crystalline, burrowed, strongly to slightly dolomitic mollusc-fragment biomicrite, other features: -- at 344, 347 - wispy streaks with oysters, only slightly dolomitic -- at 347 - small, thin, dark chert streaks -- at 347.5 - becomes denser and less porous -- at 350-57 - light-brown, porous shelly dolomitic streak	21.5
358.5-405	9. Limestone: light-gray, dense, massive, fine- to medium-grain, mollusc-fragment biomicrite; scattered stromatoporoids and snails, light-gray chert nodules abundant in upper 2 feet, scattered miliolids; other features: -- at 380, 385 - thin marly streaks -- at 387-89 - burrowed -- at 391-97 - Toucasia and oysters common in matrix as above -- at 398-402 - burrowed, slightly dolomitic -- at 402-04 - crystalline and cavernous -- at 404-05 - miliolid biosparite	46.5
	Regional Dense Member--	
405-427	10. Marly limestone: medium-gray, dense, wispy, burrowed, argillaceous, carbonaceous, fine mollusc-fragment and whole-mollusc micrite and biomicrite; wisps consist of fine, coalescing black to dark-gray, carbonaceous streaks; scattered Exogyra, pectens; other features: -- at 405-06, 410-11, 415-16, 420-23 - notably marly and wispy -- at 425-27 - color changes to light grayish-orange; contains a little more shell debris, grainier, still marly biomicrite -- at 427 - lower contact gradational over about 1", very wispy	22
	KAINER FORMATION	
	Grainstone Member--	
427-484	11. Limestone: light yellowish-gray, porous, massive, medium- to coarse-grain, well-sorted, miliolid and mollusc-fragment biosparite; other features: -- at 433-35 - wispy, marly streak -- at 435-38 - muddy streak -- biomicrite with leached grains -- at 447 - light brownish-gray chert nodule -- at 453-58 - muddy streak -- fairly dense micrite and biomicrite, not lithographic -- at 455-62 - very coarse crystalline, porous limestone grading downward to very fine-crystalline biomicrite in lower foot -- at 477 - large lithographic micrite clasts in miliolid biosparite -- at 478-80 - thin bedded, light-gray lithographic micrite, showing incipient brecciation -- this is the porcellaneous limestone bed that is so widely traceable through the Edwards Plateau -- at 482-84 - Toucasia in biomicrite matrix	57
	Dolomitic Member--	
484-547	12. Crystalline limestone, travertine, and red clay: light-gray to light-brown, very cavernous and porous, cherty, medium- to very coarse-crystalline, massive calcite, travertine and secondary limestone with soft, red clay in caverns, as described by well-site geologist, J. L. Hair: "Series of open to partially-open cavities with seams and/or beds of hard limestone; partially filled with nodular, honeycombed calcite and red clay"; other features: -- at 486-90 - light-gray to light-brown, hard, fine- to very fine-crystalline siliceous limestone and chert -- at 498.5-500, 504-07.5 - incompletely recrystallized, burrowed and granular -- at 507.5-16 - caverns with red clay filling	

Depth (feet)		Thickness (feet)
	-- at 521 - light-brown chert nodules -- at 523-44 - cavernous, with abundant red clay -- at 544-47 - hard, dense, medium-crystalline limestone	63
547-566	13. Limestone: light, brownish-gray, very fine- to fine-grain, moderately sorted, slightly recrystallized, mollusc-fragment and miliolid biomicrite, grading downward to porous and cavernous, very coarse-grain, whole-mollusc biosparite; molluscs include Turritellid snails, oysters, heart clams, and caprinids	19
566-585	14. Crystalline limestone, dolomite, collapse breccia and clay: light to medium brownish-gray, porous, medium-crystalline, porous limestone and micrite overlying brecciated cavernous zone with abundant red clay; other features: -- at 569-73 - mollusc-fragment and miliolid biosparite	19
585-658	15. Limestone: light-gray, compact, poorly-sorted, very fine- to medium-grain, mollusc-fragment and miliolid biomicrite and biosparite; other features: -- at 586-89 - cavernous, no recovery -- at 590-91 - dolomitic burrow-fillings -- at 596-97 - crystalline limestone streak -- at 614-21 - very muddy interval -- at 624-29 - coarse-crystalline calcite overlying cavernous medium-gray dolomite -- at 629.5, 633, 641.5 - medium-gray to brown chert nodules -- at 638, 656-58 - yellowish-gray, wispy, nodular marly streak -- at 643.5-44.5 - burrows in yellowish, granular biomicrite filled with light-gray, mollusc-fragment biosparite -- at 648-50 - slightly dolomitic -- at 652-54 - recrystallized	73
658-680	16. Dolomite: light-brown to medium-gray, porous to dense, very fine- to fine-crystalline, dolomitized mollusc-fragment biomicrite (658-665), burrowed whole-rudist biomicrite (665-671), and wispy, burrowed, whole-mollusc biomicrite (671-680); thin recrystallized layer near top of interval, at 659-660	22
680-695	17. Dolomitic limestone: dark- to medium-gray, dense, carbonaceous, wispy, burrowed, partly dolomitic mollusc-fragment and miliolid biomicrite; dolomitic at 683-687; burrow fillings more dolomitic; other features: -- at 692-95 - scattered large whole oysters and spar-filled vugs	15
695-707.5	18. Marly limestone: medium- to light-gray, dense, carbonaceous, argillaceous, nodular, wispy, burrowed whole-mollusc and mollusc-fragment biomicrite; abundant whole-molluscs (protocardid clams, Turritellid snails, Exogyra and Gryphaea) in marly, wispy intervals at 702, 705, 709-11; thin gray dolomite streak at 707.5 overlain by large clasts	12.5
	GLEN ROSE FORMATION	
707.5-730	19. Dolomite: light-brown, fine-crystalline, burrowed, dolomitized micrite and mollusc-fragment biomicrite -- at 708.5-11 - marly streak with Exogyra texana	22.5

CALDWELL COUNTY; SHELL, NO. 1 CAYTON CORE-HOLE (2); THOMAS MAXWELL SURVEY, A-188

	GEORGETOWN FORMATION	
1140-1144.8	1. Limestone: light grayish-brown, argillaceous, wispy, burrowed, pyritic, glauconitic, mollusc biomicrite, IA/B; common Globigerina and calcispheres; some grains are discolored dark-gray, particularly around periphery; pyrite particularly abundant in lower foot, also glauconite; lower boundary abrupt with thin, dark-gray, marly streak containing pisoliths, Georgetown and Edwards clasts immediately above Edwards contact	4.8
	EDWARDS GROUP PERSON FORMATION	
1144.8-1147	2. Limestone: light-brown, churned, mollusc and miliolid muddy biosparite; mostly IA; mud content varies; minor changes as noted: -- at 1145.5-46.0 - rounded, light-tan to brown, Edwards dolomite cobbles in gray dolomite matrix; note some glauconite; IIIB -- at 1146.5-47 - gradational lower boundary	2.2
1147-1148.7	3. Calcitic dolomite: light-tan, churned, mollusc and miliolid dolomitized biomicrite; IIIB; some horizontal current streaks; skeletal debris consists of whole small oysters, mollusc fragments, miliolids; burrows more dolomitic in upper 2 feet; few flat clasts. -- at 1147.4 - possible crust fragments -- at 1148.4 - burrows filled with glauconitic, pyritic clast intrasparite; many clasts discolored; looks like Georgetown lithology but no pelagic forams or calcispheres; dolomitized	1.7
1148.7-1150.5	4. Dolomite: medium-brown, massive, featureless, fine-crystalline dolomite; IIIB/C; difficult to distinguish textural components; rocks so leached that determination of what was originally present is impossible	1.8
1150.5-1152	5. Limestone: very light-cream, poorly-sorted, mollusc biomicrite; IA; molluscs are oysters, Toucasia, flat clams	1.5
1152-1156.4	6. Limestone: medium- to light-brown, wispy, burrowed, miliolid and mollusc biomicrite and muddy biosparite; IIIB; notably wispy in upper 6"; many grains leached throughout; becomes wispy, with fewer miliolids at 1154; slightly dolomitic towards bottom	4.4

CALDWELL COUNTY; SOUTHERN PRODUCTION COMPANY, NO. 6 JOLLY (5); LARREMORE FIELD

	GEORGETOWN FORMATION	
1260.5-1267	1. Limestone: light-gray to cream, thoroughly burrowed and churned, argillaceous, very fine-grain, glauconitic, mollusc-fragment biomicrite; IA; also some Globigerina; becomes wispy, more burrowed, coarser below. -- at 1267 - changes to dark, laminated, carbonaceous shale with large (1/2" to 1") flat clasts of leached-mollusc dolomite	6.5
	EDWARDS GROUP PERSON FORMATION	
1267-1274.5	2. Limestone: light-gray to medium-gray, mollusc-fragment biomicrite with scattered fine shells and burrows filled with dolomite; IIIA/B, upper boundary abrupt, no other features apparent. -- at 1269 - light-gray, burrowed, miliolid biomicrite with scattered mollusc debris	7.5
1274.5-1284	3. Limestone: light-gray, very fine-grain, mollusc-fragment and miliolid biomicrite; IA/B; intensely burrowed, with some lithoclasts at top; "chalky" porosity. -- at 82 becomes finely dolomitic	9.5
1284-1306	4. Completely dolomitized, heavily oil stained, IIIB porosity; leached mollusc-shells above, some burrowing but otherwise rather homogeneous. -- at 1288-93.5 - severely disrupted stromatolitc sequences, heavily stained and probably collapsed also; almost completely dolomitized; but few streaks of limestone immediately below hard crusts; only dolomite is stained -- at 1293.5-96 - thin streak of light-gray, shelly, burrowed limestone -- at 1296-1306 - very porous, leached-shelly, coarse crystalline, oil-stained, disrupted dolomite; no distinct crusts or collapse structures; terminated by gray chert bed or nodule, 6" (?) thick at 1306	22
1306-1344	5. Limestone: light-gray, dolomitic, thoroughly burrowed, fine-grain, mollusc-fragment and miliolid biomicrite; I/IIIA/B; no oil stain. -- at 1313 - scattered oysters -- at 1317-19 - oil-stained, wispy dolomitic limestone with distinct collapse at base -- at 1319 - back to described lithology, intensely burrowed, some oysters -- at 1329 - distinct collapse and probable calcite-replaced anhydrite nodule -- at 1330 - becomes grayish-brown, burrowed, oyster biomicrite, slightly more dolomitic, few miliolids -- at 1331 - thin hard crust -- at 1332 - healed fracture; brown, dolomitic limestone becomes more dolomitic downward; wispy to 1340 -- at 1340-44 - hard crust sequence with two stromatolites at 1341 and 1342 with completely leached, granular dolomite between	38
1344-1349	6. Limestone: medium-brown, dense, mollusc biomicrite and biosparite; IA; large shells and grains in upper foot; abrupt upper boundary; shells drop out below, rock gets muddier with few shells and pellets; in bottom foot changes to brown, leached-shelly dolomite and gray fossiliferous chert with abundant druse	5
1349-1359.5	7. Dolomite: light-gray, fine-crystalline, thoroughly leached, mollusc-fragment biomicrite; IIIB; some healed fractures, calcite-replaced anhydrite nodules and incipient collapses. -- at 1356.5 - stromatolitic pebbles. -- at 1357-59.5 - superb, very light-gray, punky, stromatolite sequence	10.5
1359.5-1365	8. Calcitic dolomite: very light-gray, rather homogeneous, evenly-and finely-laminated, fine-grain, mollusc-fragment biomicrite; IIIB	5.5

Depth (feet)		Thickness (feet)
1365-1380	9. Limestone: light-gray, dense, poorly-sorted, muddy miliolid and oyster biomicrite; IA; abundant spar filling-in shell cavities, cracks, etc. -- at 1367 - thin, shaly streak with vague crust -- at 1369.7 - becomes intensely burrowed -- at 1371-76 - common small nodules with abundant wispy structures	15
	Regional Dense Member--	
1380-1397	10. Limestone: light-gray, very wispy, very fine-grain, mollusc-fragment and miliolid biomicrite; IA; skeletal debris is very fine, very fragile. -- at 1383 - acquires greenish-gray cast, becomes more argillaceous -- at 1386-88-notably argillaceous, soft, burrowed -- at 1385-95 - intensely burrowed and churned -- at 1395 - matrix of above generally continues with influx of oyster shells; note reddish-colored burrows and oyster shells, also few small clasts of underlying unit	17
	KAINER FORMATION	
	Grainstone Member--	
1397-1402.5	11. Limestone: very light-gray to cream, well-sorted, miliolid biosparite; IIIA. -- at 1401-02.5 - dolomitized, burrowed and wispy interval, with hard crust sequence with thin pebble layer at top	5.5
1402.5-1423	12. Limestone: very light-gray to cream, poorly-sorted, muddy oyster and miliolid biosparite, IA/B. -- at 1407 - most large shells drop out -- at 1411 - two 2" dark-gray chert nodules -- at 1414 - becoming muddier and burrowed -- at 1417-18 - streaks of coarse mollusc shells -- at 1422-23 - coarsely shelly and wispy	20.5
1423-1432	13. Limestone: medium- to light-gray, well-sorted, very fine-grain, mollusc and miliolid biosparite; IA/B; dark-gray chert nodule at 1423. -- at 1425 - begins to grade downward to coarser shell material, still contains miliolids -- at 1428-32 - fine, even, current laminations, interbeds of miliolid biosparite with fine silt-sized mud streaks	9
	Dolomitic Member--	
1432-1445	14. Dolomite: medium- to light-brown, shelly, leached dolomite; IIIB/C; rock has general disrupted look above, grading down to distinct coarse collapse, then to good stromatolite, then to leached shelly dolomite, then (at 1437-39) superb collapse breccia. -- at 1439-45 - leached, burrowed, shelly dolomite	13
1445-1451	15. Limestone: light-brown, slightly wispy, miliolid biosparite; IA; some horizontal current laminae	6
1451-1462.5	16. Dolomitic limestone: light brownish-gray, burrowed, dolomitic, miliolid intramicrite and biomicrite; IA; becomes more dolomitic downward, clasts are small, coated aggregates containing miliolids. -- at 1455 - becomes muddier, clasts less abundant	11.5
1462.5-1488	17. Dolomite: medium-brown, porous, massive, homogeneous, fine- to medium-crystalline, dolomitized, mollusc-fragment biomicrite; IIIB; burrowed near base. -- at 1466-68, 1469.5-77, 1478-79 - streak of light brownish-gray, miliolid biosparite, non-dolomitic -- at 1468-69.5 - light-brown, disrupted, spar-filled, dolomite collapse with distinct crust at 1469	25.5
1488-1491	18. Limestone: light-brown, fine- to medium-grain, muddy miliolid and mollusc-fragment biosparite with scattered large, composite clasts throughout; IA	3
1491-1540	19. Dolomite: medium-brown, medium-crystalline, porous, disrupted and collapsed, dolomitized micrite and leached-shell biomicrite with streaks of wispy, dolomitic, miliolid and mollusc biomicrite; IIIB; other features: -- at 1511-21 - spar-lined vugs and light-brown chert nodule -- at 1529, 1532 - dark bluish-gray chert nodule -- at 1535-36, 1539-40 - distinct disrupted zones with hard crusts	49
1540-1552	20. Dolomitic limestone: light-cream to light brownish-gray, poorly-sorted, dolomitic, mollusc and miliolid biomicrite; IA and IIIA; scattered whole Toucasia and oysters; dolomitization streaky. -- at 1549 - wispy streaks -- at 1549.5-50 - disrupted dolomite zone	12
1552-1586	21. Dolomite: medium grayish-brown, medium-crystalline, disrupted, porous, spar-filled, collapsed dolomite and medium-brown, burrowed, wispy, miliolid and mollusc-fragment micrite and biomicrite; IIIB and IIIA. -- at 1566 - distinct exposure surface, cracked and brecciated below -- at 1573.5 - root marks -- at 1576 - severely burrowed -- at 1580 - disrupted zone with crusts -- at 1575-86 - wispy, miliolid biomicrite becomes less dolomitic downward	34
1586-1617	22. Dolomite: medium-brown, homogeneous, fine-crystalline, dolomitized micrite; IIIA/B; other features: -- at 1593 - becomes softer and punkier -- at 1596-97 - coarse-grain, miliolid intrasparite with coated clasts -- at 1605-1606 - intensely burrowed, with coarse-shelly burrow-fills completely dolomitized -- at 1606-08 - dolomitized, coarse, mollusc-fragment biosparite -- at 1608-13 - massive, homogeneous, fine-crystalline, dolomitic micrite -- at 1613 - gray chert nodule	31
1617-1680	23. Dolomite and dolomitic limestone: medium-brown, very porous, medium-crystalline, coarse-grain, dolomitized, mollusc-fragment biomicrite; and light-gray, burrowed, dolomitic, miliolid and mollusc-fragment biomicrite and biosparite; IIIB and IIIA. -- at 1636 - well-sorted, mollusc-fragment biosparite -- at 1640-42 - whole Toucasia -- at 1663 - calcite-lined vugs	63
1680-1699	24. Dolomite: medium-brown, burrowed and disrupted, massive, vuggy, medium-crystalline, dolomite; IIIC, original texture mostly obliterated. -- at 1682 - superb stromatolitic crust, in part disrupted -- at 1684 - grades to light-gray, burrowed, dolomitic micrite and mollusc-fragment biomicrite with distinct hard crust and disrupted zone at 1686 -- at 1690-94 - sequence of light-gray, dolomitized, stromatolitic crusts with root marks in intervening layers of disrupted micrite -- at 1694-95 - burrowed Toucasia biomicrite -- at 1695-99 - stromatolitic crusts and disrupted micrite, all dolomitized	19
1699-1708	25. Limestone: light-gray, hard, dense, fairly well-sorted, miliolid biomicrite and muddy biosparite; IA; wispy streaks and burrowed intervals below 1705	9
1708-1732.5	26. Dolomitic limestone: light to medium grayish-brown, burrowed, wispy, mollusc-fragment and miliolid biomicrite; IA. -- at 1708-13, 1724 - Toucasia fragments and whole shells -- at 1726.5 - very wispy, reddish-brown streaks; burrowed	24.5
1732.5-1751	27. Limestone: light- to medium-gray, slightly punky, medium-grain, burrowed, mollusc-fragment and miliolid biomicrite; IA/B. -- at 1744-48 - medium-brown and light-gray, dolomitized, disrupted micrite and stromatolitic clasts	18.5
1751-1758	28. Limestone: light- to medium-gray, intensely burrowed and churned, granular, medium-grain, mollusc-fragment biomicrite; IA; scattered, large, whole oysters--Exogyra texana(?)	7
	GLEN ROSE FORMATION	
1758-1776	29. Limestone: light-gray, medium-grain, well-sorted, miliolid biosparite; IA; contains scattered micrite clasts up to 1" across. -- at 1762-64, 1771-76 - medium grayish-brown, dense, hard, finely-laminated, dolomitized micrite and mollusc-fragment biomicrite; large, dark-gray clasts at 1772	18

Depth (feet)		Thickness (feet)
	CALDWELL COUNTY; MOBIL, NO. 40 MERCER (13); LULING FIELD	
	GEORGETOWN FORMATION	
2065-2078	1. Limestone: medium- to light-gray, dense, argillaceous, mollusc biomicrite; IA; dominant fossils are oysters and clams with one ammonite, also scattered pelagic forams and calcispheres; wispy and burrowed throughout, becomes lighter gray, less argillaceous, denser, with dark mud lumps (or burrows?) in bottom three feet. Environment: marine, open circulation, shallow water, low wave energy	13
	EDWARDS GROUP	
	PERSON FORMATION	
2078-2083	2. Calcitic dolomite: medium grayish-brown, dense, highly burrowed dolomite micrite; IIIA; some preferential dolomitization in burrows; oil stain begins at 2080, Edwards-Georgetown contact is abrupt, irregular, pitted; pyrite seam marks boundary, with black soil-ooliths in low spots, also some boring. Environment: intertidal to restricted shallow marine	5
2083-2092	3. Limestone: light-tan, burrowed, Toucasia and mollusc-fragment biosparite; I/IIIA/B; some miliolids, horizontal current-streaks, wispy below. -- at 7083-84 - gray biomicrite grades into overlying unit; contains clasts of tan biosparite Environment: shallow marine	9
2092-2115	4. Gap	23
2115-2134	5. Dolomite: medium grayish-brown, porous, fine-crystalline, burrowed, dolomitized micrite; IIIB/C/D; unit is composed of 4 cycles whose individual bases occur at 2120, 2128, 2132, and 2134. -- at 2115-17 - black chert nodules containing dolomite -- at 2116-19 - large (1") round holes left by removal of gypsum nodules -- at 2123-27 - excellent IIIC/D porosity in coarse shelly biosparite -- at 2132 - superb stromatolite Environment: mostly intertidal with some supratidal, some shallow marine	19
2134-2136	6. Limestone: light-tan to cream, coarse-grain, muddy Toucasia biosparite; IIIA, leached holes filled with dense cream micrite (caliche?), carbonaceous seams above and below this bed. Environment: shallow marine	2
2136-2176	7. Dolomite: medium-brown, oil-stained, burrowed, pellet and whole-mollusc dolomitized micrite; IIIB/C; minor changes: -- at 2138-41 - lightly leached, good porosity, oysters and Toucasia -- at 2141-46 - wispy and burrowed -- at 2146 - sharp contact between leached dolomitic micrite above and tan crust below -- at 2147-51 - alternating wispy micrite and coarse biosparite -- at 2151-56 - massive dolomite micrite with gyp-nodule holes -- at 2156-69 - wispy and burrowed, shelly biomicrite; large fragments and whole shells -- oysters, Toucasia; black chert nodules at 2165, 2168 -- at 2169-73 - medium dark-brown, massive dolomite micrite -- at 2173-76 - tan, burrowed, miliolid and mollusc-fragment muddy biosparite, becoming wispy below Environment: intertidal, some restricted shallow marine	40
2176-2187	8. Limestone: light-brown, medium-grain, poorly sorted, whole and fragmented rudist muddy biosparite, I/IIIA/B; mostly Toucasia and caprinids. -- at 2180-82 - burrowed micrite overlying thin, disrupted hard crust with anhydrite void -- at 2182-86 - highly burrowed -- at 2186-87 - becomes wispy micrite Environment: shallow marine with supratidal-intertidal streak	11
2187-2202	9. Dolomite: medium-brown, oil-stained, wispy, burrowed dolomitized micrite; IIIB. -- at 2189 - spar-filled nodule -- at 2192 - void from dissolved nodule -- at 2190, 2196 - black clasts 2" thick Environment: intertidal	15
2202-2210	10. Limestone: light-brown, medium-grain, whole-fossil muddy biosparite as at 2176-87. Environment: shallow marine	8
2210-2215	11. Dolomitic limestone: light-gray, wispy, burrowed, miliolid and fine-skeletal dolomitic muddy biosparite; I/IIIA/B. Environment: shallow marine?	5
	Regional Dense Member--	
2215-2229	12. Argillaceous limestone: light bluish-gray, dense, mottled micrite; IA; with scattered fine skeletal fragments like typical Georgetown -- note cracks filled with Edwards dolomite and debris; also Georgetown-type discolored mud clasts, pink-stained areas; peculiar mottled patterns. -- at 2225-27 - concentration of Toucasia and oysters -- similar to rudist mound in Tenneco, No. 1 Ullman in same part of section Environment: shallow marine, low energy	14
2229-2231	13. Limestone: light bluish-gray, dense, wispy, clast, pellet, and miliolid biomicrite; IA; boundary zone, with common large clasts (few coated), shells, miliolids; wispy seams above, within, and below. Environment: shallow marine	2
	KAINER FORMATION	
	Grainstone Member--	
2231-2266	14. Limestone: light-cream to tan, medium- to fine-grain, moderately sorted, miliolid biosparite to biomicrite; I/IIIA; minor changes as follows: -- at 2233 - thin wispy seam -- at 2233-35 - massive miliolid biomicrite -- at 2235-37 - very wispy miliolid biomicrite -- at 2237-40 - muddy miliolid biosparite matrix with whole Toucasia shells and large shell fragments; oil-stained at bottom -- at 2240-56 - grades to miliolid-clast muddy biosparite; no large shells, oil-stained, IIIB porosity; highly altered matrix -- at 2244, 2248, 2249, 2250 - thin wispy seams -- at 2250 - large, concentric red algae colonies -- at 2256-61 - becomes finer grained, wispy, with oysters -- at 2261-62 - large travertine mass -- at 2262-66 - wispy, burrowed pellet and miliolid biomicrite; few small clasts in bottom foot; lower boundary abrupt Environment: shallow marine	35
	Dolomitic Member--	
2266-2288	15. Dolomite: medium grayish-brown, fine-grain, dolomitized miliolid and pellet muddy biosparite; IIIB; other changes as follows: -- at 2266-68 - highly burrowed, muddier and disrupted -- at 2268-76 - current streaks and wispy structures -- at 2269 - spar-filled collapse -- at 2270 - hard crust, with dark-brown chert nodule 4" below -- at 2272-73 - collapsed crusts -- at 2273-74 - apparently as at 2270-72 but completely dolomitized -- at 2274-83 - thick zone of crusts, composed of disrupted, burrowed, cracked, leached micrite, all probable supratidal; burrowed in bottom foot -- at 2283-88 - becomes light-tan, dolomitic miliolid muddy biosparite, wispy and burrowed, with common large (2") flat clasts, rock highly altered and recrystallized (weathered??) Environment: intertidal and supratidal	22
2288-2296	16. Dolomite: light brownish-gray, current-streaked, medium- to fine-crystalline, dolomitized biosparite; IIIB; thin layers of mud (crusts? storm layers? settle-out layers?) at 2293, 2294, 2295; burrowed at bottom. Environment: intertidal and supratidal	8
2296-2310	17. Dolomitic limestone: light-gray and tan, mottled, dolomitic, mollusc biomicrite; I/IIIA/B; miliolids, fine skeletal debris, oysters, Toucasia. -- at 2296 - pisoliths -- at 2296-2300 - burrowed -- at 2300-10 - grades to miliolid biosparite with current streaks -- at 2302 - brown dolomite crust 6" thick -- at 2304-06 - superb brown stromatolite sequence completely dolomitized Environment: mostly intertidal with some shallow marine	14
2310-2332	18. Dolomite: medium- to dark-brown, fine- to medium-crystalline, dolomitized micrite; IIIB. -- at 2310-15 - abundant supratidal crusts -- at 2315-20 - cracked and collapsed and disrupted, sub-crustal micrite -- at 2320-25 - burrowed, with clasts -- at 2325-29 - as at 2315-20, becoming more burrowed with common clasts below -- at 2328 - thin, black chert nodule -- at 2329-32 - disrupted supratidal mud sequence; note chalcedony	22

Depth (feet)		Thickness (feet)
2332-2334	19. Limestone: light-cream, medium- to coarse-grain, current-streaked, miliolid and clast intrasparite and biosparite; I/IIIA; few scattered dolomite rhombs	2
2334-2339	20. Dolomite: medium- to dark-gray, wispy, burrowed, dolomitic micrite; IIIB; note common cracks partially spar-filled, also few small spar-filled nodules; thin collapse breccia at base	5
2339-2343	21. Limestone: light-tan, medium- to fine-grain, clast and miliolid intrasparite and biosparite; IA; lower boundary wispy, gradational	4
2343-2353	22. Dolomite: medium-gray, wispy, pellet dolomite micrite; IIIA/B; abundant calcite-filled vugs (gyp pseudomorphs). -- at 2345 - abundant supratidal laminae -- at 2346 - jumbled collapse breccia zone, spar-filled fractures -- at 2348-53 - becomes mottled (burrowed) and wispy; lower boundary gradational; leached voids filled with spar -- at 2350 - chert band -- at 2351 - IIIB porosity	10
2353-2356	23. Dolomitic limestone: light-tan, medium-grain, clast and miliolid intrasparite; I/IIIA; some current streaks -- at 2355 - baseball-size chert nodule	3
2356-2366	24. Dolomite: medium grayish-brown, as at 2343; IIIB; minor changes as noted: -- at 2356-57 - one-foot bed of fine-grain, wispy, mollusc-fragment and muddy biosparite -- at 2357-60 - supratidal laminated dolomite -- at 2360-62 - highly burrowed -- at 2362-64 - as at 2356 -- at 2364-66 - supratidal, with cracks and crack-fillings in gray collapse breccias -- at 2365-66 - small chert nodules Remarks: a. Person Formation contains abundant supratidal sediments, with clear cycles of sedimentation. b. Kainer Formation contains abundant collapse features. c. Regional Dense Member resembles "typical" Georgetown.	10

CALDWELL COUNTY; SHELL, NO. 1 THOMPSON (26); HECTOR McNEAL SURVEY, A-199

GEORGETOWN FORMATION

1446-1460.7	1. Limestone: light- to medium-gray, generally fine-grain, poorly-sorted, burrowed, wispy, mollusc biomicrite; IA; note scattered pyrite, argillaceous and carbonaceous streaks, scattered Globigerina and calcispheres; few discolored areas beginning at about 1458; thin, dark-gray interval of Edwards clasts 6" above base of Georgetown; lower boundary intact, abrupt, described as follows: -- at 460.5 - sharp change from white, shelly biomicrite to very fissile, carbonaceous, wispy micrite with common ooliths and flat clasts of Georgetown and Edwards. Below, 1" layer of weathered Georgetown micrite; underlain by typical Edwards with Edwards clasts (up to 1/2" across); boundary abrupt and undulatory. Eight inches below top of Edwards note angular cave 2" across filled with Georgetown clasts, fissile, carbonaceous, wispy micrite matrix of 460.5 (Georgetown) containing ooliths	14.7

EDWARDS GROUP

PERSON FORMATION

1460.7-1461.8	2. Limestone: light brownish-gray, miliolid and clast biomicrite; IA; dense, burrowed	1.1
1461.8-1464	3. Dolomite: light brownish-gray, leached, shelly dolomite; IIIC; abrupt lower and upper boundary, interval of wispy, mollusc micrite in middle	2.2
1464-1474	4. Dolomitic limestone: light-cream to light-tan, burrowed, wispy, poorly-sorted, miliolid and mollusc, muddy biosparite; IA; molluscs are flat clams that occur as fairly large fragments. -- at 1465-69 - becomes dolomitic (IIIB/C), extremely dolomitic and porous in bottom 1 foot -- at 1469-70 - light-tan to white micrite with brown rudist fragments -- at 1470-74 - light-tan, wispy, miliolid and fine mollusc-fragment, dolomitic biomicrite, IIIB; few large, whole Toucasia shells Remarks: Georgetown-Edwards boundary clearly unconformable in this core.	10

FAYETTE COUNTY; BURROW, ET AL, NO. 1 WEHMEYER (6); G. W. COTTLE #5 SURVEY, A-35

EDWARDS GROUP

KAINER FORMATION

Grainstone Member--

11226-11280	1. Limestone: medium-brown and light-gray, fine- to medium-grain, miliolid intramicrite and intrasparite; IA, some IIIA, generally poor porosity; intraclasts are pellets and composite miliolid clasts; other features: -- at 11233 - half-inch to 1" patch of dead oil -- at 11237-48 - sporadic streaks of dolomite occurs as isolated scattered rhombs -- at 11245-46 - spar-filled, vertical fractures 1/8" across -- at 11248-49 - radiolite shells -- at 11252 - streak of thin, flat pebbles with dead oil around edges of mud clasts; no dead oil around miliolids -- at 11260-62 - dolomite as at 11237-48 -- at 11270-80 - well-sorted miliolid biosparite -- at 11276 - note tubular forms -- forams(?), worm tubes(?), algae(?)	54

GONZALES COUNTY; SUPERIOR, NO. 1 DUBOSE (18); DUBOSE FIELD

EDWARDS GROUP

PERSON FORMATION

Leached Member--

12085-12093.6	1. Dolomitic limestone: medium grayish-brown, burrowed and churned, wispy, dolomitic micrite and mollusc-fragment biomicrite; IA/B; in lower foot note angular lithoclasts contained in matrix of above; small oysters in mud at 12092-92.5	8.6
12093.6-12101	2. Dolomite: dark brownish-gray, dense, homogeneous dolomite; IIIA; intensely dolomitized so no structure presently visible, possibly churned	7.4
12101-12108.5	3. Dolomitic limestone: very dark-gray, dense, hard, dolomitic, oyster biomicrite; IIIA and IIIC; churned and burrowed. -- at 12107 - thin (1/4") hard crust	7.5

Collapsed Member--

12108.5-12137	4. Dolomitic limestone: medium- to dark-brown, mostly churned and burrowed, wispy (in part), dolomitic micrite and biomicrite; IIIA/B; common angular clasts and sedimentary breccias, with mud layers (small, broken), also stromatolitic crusts or storm layers at 12113-15, 12119-22, 12125-27. -- at 12135 - abundant miliolids through 1-foot interval	28.5
12137-12149	5. Dolomitic limestone: medium- and dark-brown, dense, wispy, churned and burrowed, dolomitic micrite, similar to above; IIIA/B; burrows are much bigger: 1/2"-3" across	12

Regional Dense Member--

12149-12170	6. Limestone: dark-gray, very dense, hard, argillaceous micrite; IA; churned and burrowed slightly; some intervals evenly laminated, particularly at 12165-70; flat clams abundant at 12162-63	21

KAINER FORMATION

Grainstone Member--

12170-12193	7. Limestone: medium to light brownish-gray, fine-grain, moderately-sorted, miliolid biosparite; IA; common 1/4"-3/4" haloed grains" in lower two-thirds of interval; these rinds are wispy along outer boundaries; unit muddier in lower part, with some dark staining; no dolomite	23
12193-12197	8. Limestone: dark-gray, dense, whole-mollusc biomicrite; IA; large, flat molluscs -- Chondrodonta(?), oysters(?); a few small "haloed" grains	4
12197-12247	9. Limestone: medium brownish-gray, medium- to fine-grain, moderately-sorted, miliolid biosparite and biomicrite; IA; few muddy intervals with "haloed" grains. -- at 12200-15 - distinct horizontal bedding -- at 12245-46 - two small Toucasia	50
12247-12250	10. Limestone: dark brownish-gray, dense, hard, miliolid biomicrite; IA	3

Depth (feet)		Thickness (feet)
12250-12280	11. Limestone: essentially as at 12240-47; note peculiar distinctive black and brown aspect where irregular, possible pyrobitumen areas are black, miliolid biomicrite areas are brown	30
12280-12297	12. Limestone: much as above, but grades rather abruptly into medium-brown, fine-grain, miliolid biomicrite; IA; even, horizontal, current-streaks	17
	Dolomitic Member--	
12297-12312	13. Dolomitic limestone: dark-brown, churned and burrowed, dolomitic micrite; less dolomitic than in Person Member, evenly-scattered rhombs, some thin 4"-6" intervals with good IIIB porosity; lower boundary gradational	15
12312-12367	14. Limestone: medium-brown, fine-grain, miliolid biomicrite; IA; becomes slightly dolomitic at 12321-23; medium- to coarse-grain, miliolid and mollusc-fragment biosparite at 12333-34; pyrobitumen at 12363	55
12367-12371	15. Dolomitic limestone: medium grayish-brown, disrupted, dolomitic micrite; IIIB; hard layer, angular mud clasts; stylolite boundary at base	4
12371-12374	16. Limestone: miliolid biosparite as at 12197-247; non-dolomitic	3
12374-12381	17. Gap	7
12381-12389	18. Dolomitic limestone: dark brownish-gray, whole-mollusc and pelletal biomicrite; I/IIIA; dolomite occurs as sparse, scattered rhombs	8
12389-12392	19. Gap	3
12392-12397	20. Limestone: light grayish-brown, fine- to medium-grain, very well-sorted, tightly-packed miliolid oosparite; IA; ooliths with only one coat; grades downward to miliolid biomicrite	5
12397-12402	21. Dark oil-stained, porous dolomite; almost no structure visible; IIIB	5
12402-12405	22. Gap	3
12405-12430	23. Limestone: medium brownish-gray, medium- to fine-grain, miliolid biosparite and biomicrite; IA; essentially as at 12197-247; burrowed and churned micrite intervals -- at 12407-11 - gap	25
12430-12460	24. Dolomitic limestone: medium grayish-brown, burrowed and churned, dolomitic, miliolid and mollusc-fragment and pellet biomicrite and micrite; IIIA; dolomite ranges throughout from very sparse to common rhombs	30
12460-1286	25. Dolomitic limestone; light brownish-gray, medium- to fine-grain, moderately- to well-sorted, weakly dolomitic, muddy, miliolid biosparite; IIIA	26
12486-12508	26. Dolomitic limestone: light-brown, burrowed and churned, dolomitic micrite and biomicrite; mostly IIIA; lower boundary gradational	22
12508-12574	27. Dolomitic limestone: dark grayish-brown, dense, rather homogeneous, dolomitic micrite; IIIA	66

GONZALES COUNTY; MOSBACHER, NO. 1 FRISBIE (19); DUBOSE FIELD

EDWARDS GROUP
PERSON FORMATION
Marine Member--

12400-12402	1. Limestone: medium- to dark-brown, miliolid biomicrite; IA; scattered pellets, shell fragments, common miliolids; one spar-filled fracture	2
12402-12430	2. Limestone: medium brownish-gray, well-sorted, medium-grain, rudist-fragment biosparite; IA; chert occurs as detrital grains; large, scattered, rudistid fragments at top; grains are white-to cream-colored, with faint suggestion of coating or leaching(?) before deposition; shell debris becomes progressively finer downward. -- at 12408-13 - diverse skeletal grains -- algae, rudist, pellets, some miliolids -- at 12412-13 - very fine-grain and wispy -- at 12413-19 - gap -- at 12419-30 - scattered clasts of pelleted miliolid micrite, some with coats -- at 12425-30 - Toucasia fragments common	28

GONZALES COUNTY; GULF COAST LEASEHOLDS, NO. 1-A JACOBS (15); J. L. WOOD SURVEY, A-473

DEL RIO FORMATION

11350-11358	1. Argillaceous limestone: dark brownish-gray, fissile, pyritic, wispy, argillaceous, fine-skeletal biomicrite; IA; skeletal fragments consist of fragile molluscs, calcispheres, few pelagic forams; lower boundary gradational within 2 feet	8

GEORGETOWN FORMATION

11358-11519	2. Limestone: medium grayish-brown, dense, wispy, burrowed, pyritic, slightly argillaceous, fine-skeletal biomicrite; IA; abundant fragile molluscs, common calcispheres, Globigerina. -- at 11369-75 - gap -- at 11375 - becomes somewhat lighter brown, also less argillaceous -- at 11383-87 - becomes wispy, with carbonaceous streaks, darker, thinner bedded -- at 11387-93 - gap -- at 11393.5 - thin argillaceous streak overlying two light-brown, angular clasts of Georgetown lithology in Georgetown matrix -- at 11394-98 - massive, burrowed micrite with very thin, scattered, carbonaceous wisps -- at 11398-415 - gap -- at 11423-25- very dark, argillaceous, wispy interval -- at 11425-28 - gap -- at 11433-50 - very dark, argillaceous, wispy, pyritic interval, gradational boundaries -- at 11464 - few small (1/4") light-brown, stromatoporoid masses -- at 11468-91 - gap -- at 11499-500 - light-brown, calcisphere-Globigerina micrite clasts in medium-brown, argillaceous, wispy, intramicrite matrix. Large clasts appear weathered	161
11519-11528	3. Gap	9

EDWARDS GROUP
PERSON FORMATION
Cyclic Member--

11528-11541	4. Limestone: light-brown, poorly-sorted, miliolid and radiolite biomicrite; IA; micrite is not altered to microspar; radiolites occur whole and as large fragments (2"); scattered stylolites -- at 11531 - becomes medium-brown, slightly wispy, with oysters(?); note chert-replaced shells; more skeletal debris -- at 11534 - scattered Toucasia -- at 11537.5-38.5 - miliolid biosparite -- at 11539.5 - coarse-skeletal biosparite	13
11541-558.5	5. Limestone: light- to medium-brown, fine-grain, well-sorted pellet, mollusc-fragment and miliolid biosparite; IA. -- at 11542-45 - gap -- at 11546-49 - note burrowing -- at 11549 - becomes wispy, some burrowing continues, this looks a little like Georgetown lithology, but no pelagics, also has miliolids -- at 11554-55 - thin streak of light-brown, coral and mollusc biomicrite; corals are whole, Cladophyllia-type, also some caprinid and radiolite fragments and Chondrodonta; grades to 4" of finely laminated biosparite as above -- at 11555 - as at 11549-54 but with few larger shell fragments; fine, well-sorted, laminated micrite and biomicrite -- at 11556-57 - dark brownish-gray, graded bed and good horizontal laminations -- at 11557-558 - severely burrowed, brown burrows in black matrix	17.5
11558.3-11559.7	6. Dolomite: medium to dark brownish-gray dolomite sequence as follows: -- at 11558.3-558.8 - massive, gray, dolomitized micrite; IIIB -- at 11559-59.4 - laminated, calcitic dolomite, darker, with soft sediment slump; burrowed below -- at 1159.4 -59.6 - very thin collapse with dolomitized clasts overlying 1/2" anhydritic layer overlying 1/2" anhydrite and clasts all mixed up; the entire rock almost totally chert-replaced	1.4

Depth (feet)		Thickness (feet)
11559.7-11580.5	7. Limestone: very dark-gray, wispy, carbonaceous, pelleted, miliolid biomicrite; IA; few mollusc-fragments, some "wormy-looking" coated miliolids as in top of Kainer Member, reworked(?); less wispy below 11566-68. -- at 11569-73 - burrowed -- at 11574-79 - common Toucasia; shells were apparently filled with mud, then shell material was leached away, later filled with spar; common pellets -- at 11579-80 - large shells gone, few carbonaceous streaks 1/2" thick, burrowed and churned	20.8
	Marine Member--	
11580.5-590	9. Limestone: light to medium grayish-brown, well-sorted, fine- to coarse-grain, mollusc-fragment intrasparite; IA; intraclasts include lithoclasts, pellets; nearly all grains are coated; note also common, white chert grains replacing shell fragments	9.5
11590-11629	10. Gap	39
	Leached Member--	
11629-11673	11. Limestone: medium-brown, well-sorted, fine-grain, mollusc-fragment intrasparite and intramicrite; IA; considerable mud; also wispy and burrowed throughout; from 11629-36 dolomite occurs as individually isolated, evenly-scattered rhombs. -- at 11636-44 - interval of mollusc-fragment intrasparite, medium-grain, almost no dolomite, not wispy, scattered white chert, grains coated -- at 11647-60 - intrasparite as at 11636-44, no dolomite -- at 11660-61 - very fine-grain and wispy (wisps very fragile, fine, scattered) -- at 11661-67 - intrasparite as at 11647-60 -- at 11667-68 - streaks of light-brown, miliolid micrite, stylolitic boundaries -- at 11668-71 - return to described lithology; somewhat more muddy and dark, burrowed (dolomite in burrows) with rounded, mud clasts; wispy, angular, mud clasts with dolomite in cracks at 11670-71 -- at 11671-72 - dark-brown, burrowed, very fine-grain, pellet intramicrite, clasts gone -- at 11672-73 - as above, becoming dolomitic	44
	Collapsed Member--	
11673-11675	12. Dolomite: medium-gray, very coarse, collapse breccia; IIIA/B; pieces consist of four to five different types, including apparent stromatolites. Note contact with unit above gradational within 2'	2
11675-11690	13. Gap	15
11690-11695	14. Dolomitic limestone: light to medium grayish-brown, poorly-sorted, whole-mollusc biomicrite; IIIA; molluscs are mostly Chondrodonta, few radiolites; note dolomite tends to avoid mud-filled areas of shells, occurs instead around outside; does this argue for early dolomite(?)	5
11695-11700	15. Limestone: light grayish-brown, well-sorted, medium- to coarse-grain, mollusc biosparite; I/IIIA; note scattered algal fragments; all grains coated	5
11700-11709	16. Calcitic dolomite: light grayish-brown, well-sorted, medium- to fine-grain, mollusc biosparite; IIIA/B; unit of above grades into this, adding dolomite, becoming finer-grain	9
11709-11717	17. Dolomitic limestone: dark-brown, burrowed, wispy, slightly dolomitic, very fine-grain, pellet intramicrite; IA; scattered, oyster fragments at 11712-14. -- at 11716 - rounded, small, mud clasts, light-brown, 1/16" to 1/4" across	8
11717-11723	18. Calcitic dolomite: dark brownish-gray, dense, homogeneous, essentially featureless, dolomitized micrite; IIIA; note small (1/2"-1") calcite-replaced anhydrite nodules at 11718-19; minor changes as noted: -- at 11719 - becomes weakly dolomitic, then non-dolomitic at 11720 with scattered pyrite	6
	Regional Dense Member--	
11723-11740	19. Argillaceous limestone: very dark brownish-gray, wispy, carbonaceous, argillaceous, pyritic, mollusc micrite; IA; shells are fragile clams and snails, mostly whole; gradational upper boundary. -- at 11726-33 - mud-pellet and fossil-cast biosparite; argillaceous interbeds; less clastic from 11730-33 -- at 11733-40 - dense, wispy, burrowed, argillaceous micrite without shells -- at 11739 - first reworked Kainer clasts, also single miliolids; lithology of above continues	17

GONZALES COUNTY; HARKINS, NO. 1 KELLEY (8); AUSTIN PEIRCE FIELD

EDWARDS GROUP
KAINER FORMATION

	Grainstone Member--	
11582-11615	1. Limestone: medium- to dark-brown, medium- to fine-grain, well-sorted, miliolid biosparite; IA and IIIA/B; porosity in general poor; dolomitic streaks at 11585, 11590, 11596, 11597; below 11597 fauna is more varied with mollusc-shell fragments, pellets; distinct, black dead oil abundant from about 11612-15	33
11615-11650	2. Gap	35
11650-11699	3. Limestone: dark grayish-brown, medium- to fine-grain, well-sorted, miliolid, mollusc-fragment biosparite; IA, IIIA/B; generally poor porosity. -- at 11650-60 - heavily oil-stained (dead oil), note oil stain occurs between particles -- at 11660 - note streak of dense micrite -- at 11662 - thin, dolomitic streak -- at 11664-71 - rock is medium grayish-brown -- at 11679-80, 11682, 11683, 11688, 11696 - dolomitic streaks -- at 11684 - white calcite patch	49
11699-11702	4. Gap	3
	Dolomitic Member--	
11702-11727	5. Limestone: dark grayish-brown, medium-grain, well-sorted, miliolid and mollusc-fragment biosparite; IA, IIIA/B; generally poor porosity; heavily oil-stained in part -- at 11705-06, 11708-09, 11718-21 - dolomitic streaks -- at 11721-25 - gap	25
11727-11772	6. Dolomite: medium to dark grayish-brown, fine-crystalline, dolomitized, miliolid biosparite; IIIA/B; degree of dolomitization varies; streaks heavily oil-stained between grains; many grains with coatings; mollusc-fragments more abundant in lower half; rock silicified in upper foot	45

GONZALES COUNTY; TENNECO, NO. 1 ULLMAN (11); AUSTIN PEIRCE FIELD

EDWARDS GROUP
PERSON FORMATION

	Marine Member--	
11740-11750	1. Limestone: medium grayish-brown, burrowed, wispy, medium- to coarse-grain, mollusc-fragment and pelletal biomicrite; IIIA/B; shells are various rudists, none whole, some replaced by spar; also Cladophyllia corals; scattered microspar seems to occupy grain interstices beginning at 11741; dense in upper 2-3 feet. -- at 11744 - grades to well-sorted, medium-grain, coated-clast intrasparite with microspar in interstices; not burrowed; some fine, blue-gray chert -- at 11745 - two large, whole-stromatoporoid masses -- at 11746 - abrupt change to fine-grain, mollusc-fragment biosparite, microspar massive and homogeneous; few scattered, dolomite rhombs -- at 11748 - grades back to original lithology for one foot (note Toucasia), then becomes finer-grain, better sorted, wispy, burrowed, and grades into unit below	10
	Leached Member--	
11750-11781	2. Limestone: dark grayish-brown, homogeneous, very fine-grain, well-sorted, finely- and evenly-stratified, pelletal and skeletal biomicrosparite; IIIA/B; microspar occupies grain interstices; burrowed, wispy and dolomitic in upper foot. -- at 11762-64 - gap -- at 11764-69 - rock color changes to medium-tan, texture unchanged; at base, color changes back abruptly -- oil stain(?) -- at 11766 - dead oil in wispy dolomite streaks; note large, round, pellets filling what looks like a crab burrow -- at 11770-75 - grades abruptly to medium brownish-gray, burrowed, calcitic dolomite with scattered soft-clasts -- at 11775-77 - grades back to original lithology -- at 11777-81 - becomes dolomitic, burrowed and wispy, matrix otherwise as above	31

Depth (feet)		Thickness (feet)
11781-11790	3. Calcitic dolomite: medium-gray, massive, burrowed, calcitic, dolomitized micrite; IIIA/B; few fragile, leached, mollusc shells. -- at 11785 - note dark 8" streak containing common 1/2"-1" oyster shells -- at 11786 - two-inch hard crust -- at 11789-90 - highly burrowed.....	9
	Collapsed Member--	
11790-11799.5	4. Limestone and dolomite: dark grayish-brown, carbonaceous, cyclic, tidal flat, micrite sequence as follows: -- at 11790-92 - dark-gray, dense, burrowed, wispy, oyster biomicrosparite with little or no dolomite -- at 11792-95 - as above, shells drop out, but rounded clasts 1/4"-1? in diameter appear; highly burrowed and disrupted (root cracks(?) at 11793) -- at 11795-97 - six-foot, soft crust (or channel slump), then down into rounded-clast, mud-filled breccia -- at 11797-98 - two 3" distinct dolomite crust zones, both broken up somewhat and separated by dark, pellet and clast micrite -- at 11798-995.5 - dark, distinctly laminated, micrite crust; abrupt lower boundary.....	9.5
11799.5-11805	5. Dolomite: light brownish-gray, leached, burrowed, collapsed (in part), dolomitized micrite; IIIA/B; sequence as follows: -- at 11799.5-808 - leached, burrowed micrite with large (1") calcite pseudomorphs after anhydrite nodules, leached, shell fragments (now spar-filled); intensely burrowed at base -- at 11804-05 - supratidal crust sequence, overlain by fine-grain breccia in micrite matrix.....	5.5
11805-11816	6. Limestone: dark grayish-brown, dense, highly burrowed, wispy, fine-grain, clast and skeletal micrite; IA; clasts are rounded, rather small, scattered; shells are spar-replaced molluscs and snails. -- at 11810 - settle-out laminations -- at 11814 - two feet of dolomitized, disrupted intramicrite, with abrupt, undulose lower boundary; 3" hard crust at base.....	11
11816-11817	7. Chert and dolomite: spectacular collapse breccia totally replaced at top by light grayish-brown chert; upper surface almost surely an exposure surface; common pieces of crust and stromatolite in breccia; large fragments in mud matrix; porosity IIIA/B; note dead oil in cracks.....	1
11817-11819	8. Dolomitic limestone: dark-brown, highly-burrowed, medium- to coarse-grain, pellet and clast micrite and intramicrite; I/IIIA; note also scattered mollusc-fragments.....	2
11819-11824	9. Dolomite: medium brownish-gray, earthy, very coarse-grain, angular-clast collapse breccia; IIIC; ground mass porosity augmented by vugs between clasts; excellent porosity; clasts include common crusts, mud fragments; the rock has been severely leached.....	5
11824-11834	10. Dolomite: medium-brown, massive, burrowed, pellet(?), dolomitized micrite; IIIB; minor changes as described. -- at 11824-26 - distinct, stromatolitic-crust sequence, more or less intact and not collapsed -- at 11826-29 - as described above -- at 11829-30 - as above, but gray and thoroughly leached -- at 11830-33 - highly burrowed, wispy in part, with some horizontal, streaky distribution of dolomite -- at 11833-34 - large, spar-filled, angular collapse with considerable calcite veining; rock becomes medium-gray.....	10
11834-11850	11. Limestone: dark to medium grayish-brown, dense, wispy, burrowed micrite; IA; mud is very pure and fine; some soft-pellets are discernable; minor changes as noted: -- at 11835 - one foot of miliolid biomicrite that looks like Kainer lithology; gradational above and below -- at 11836-44 - less disrupted by burrowing, also fewer wisps; scattered miliolids -- at 11839 - spar fills near-vertical crack plus 6 small round cavities (leached shell holes?) -- at 11844-45 - highly burrowed, with large (up to 4") soft clasts -- at 11845-50 - very homogeneous, dense micrite, some scattered, very fine-crystalline, dolomite rhombs -- at 11848 - one-inch streak of gastropod, muddy biosparite, gradational above and below.....	16
	Regional Dense Member--	
11850-11856	12. Limestone: dark brownish-gray, very wispy, burrowed, argillaceous, mollusc micrite; IA; note scattered, fine, pyrite crystals; molluscs are small, fragile, thin-shelled clams and snails; note also soft-pellets; lower surface abrupt, probable exposure surface.....	6
11856-11868	13. Limestone: dark grayish-brown, burrowed, whole-mollusc, muddy biosparite; IA; shells have been replaced by white spar, also in part by chalcedony; molluscs are oysters, Toucasia, caprinids, gastropods; becomes clayey in lower foot, then grades into unit below. This interval probably represents a small shell bank or mound within the Regional Dense Bed; highly disrupted, burrowed in upper few feet.....	12
11868-11870	14. Limestone: dark brownish-gray, dense, burrowed, wispy, pyritic, argillaceous micrite; IA; scattered clasts and miliolids less common in upper foot, become more abundant gradually downward; lower boundary is abrupt, irregular, with clasts of underlying lithology 1"-2" above contact.....	2
	KAINER FORMATION	
	Grainstone Member--	
11870-11992	15. Limestone: medium-brown, medium-grain, well-sorted, miliolid and clast biosparite; I/IIIA/B; porosity scattered, intergranular; note distinct, horizontal current streaks. -- at 11878-80 - influx of coated clasts and shell fragments, some up to 2" across; some microspar here; fair porosity -- at 11880-83.5 - streak of intramicrite with Toucasia, pellets, miliolids, few clasts -- at 11883.5 - return to dominant lithology of above, slightly finer-grain, light gray-brown -- at 11885 - clasts drop out, leaving clean miliolid biosparite, some scattered burrows -- at 11895 - becomes finer-grain, muddy, fewer miliolids, more soft-pellets, burrowed, with few coarser-grain streaks -- at 11905 - becomes fine-grain, well-sorted, miliolid and pellet biosparite -- at 11909 - horizontal current streaks and cross-bedding -- at 11910-11 - burrowed -- at 11911 - essentially as above, sorting poorer, grain size about the same; slightly darker -- at 11920-25 - as above, but with common wispy streaks -- at 11925-47 - fine-grain, skeletal-pelletal biosparite; most pellets have been dissolved after cementation, leaving voids; porosity good, permeability poor -- at 11927-33 - medium- to dark-brown, dense, whole-mollusc biomicrite and muddy biosparite; molluscs are Toucasia, caprinids, oysters; in bottom foot, grades downward into clast and miliolid biosparite, then into unit below -- at 11933-45 - medium gray-brown, current-streaked, medium- to coarse-grain, miliolid intrasparite and biosparite, some microspar in grain interstices, clasts medium- to coarse-grain, particularly abundant at 938-41; some fair porosity -- at 11945-57 - becomes finer-grain, denser, clasts drop out, mud content somewhat higher, note also burrowing -- at 11957-69 - becomes coarser-grain with less mud -- at 11969-91 - acquires scattered, medium to coarse dolomite rhombs, becoming more abundant downward; also microspar; burrowed; good IIIB porosity -- at 11972 - two-inch round, white, spar-replaced, anhydrite nodule -- at 11984-88 - gap.....	122
	Dolomitic Member--	
11992-12078	16. Dolomitic limestone: medium brownish-gray, medium-grain, fairly well-sorted, miliolid, mollusc-fragment and clast biosparite and intrasparite; IIIA/B and IIIB (considerable), very good porosity here; clasts large and numerous in top 2 feet; note generally fewer miliolids, more mollusc-fragments and pellets; upper 3 feet non-dolomitic. -- at 12995 - becomes dolomitic (large rhombs) with few calcite-replaced, anhydrite nodules; current streks, few streaks of clasts -- at 12001 - becomes burrowed, more strongly dolomitic -- at 12007 - darker gray, channel-slump deposit; looks highly leached; note spar-filled, incipient, collapse-cracks; thoroughly dolomitized -- at 12009-10 - distinct, collapse breccia with silica-replaced "pisolites" in bottom 3"; this is probably a replacement structure; abrupt, lower boundary -- at 12010-14 - essentially as at 12007-09 -- at 12014-30 - only slightly dolomitic, fine-grain, mollusc-fragment biosparite; burrowed slightly -- at 12030 - abrupt, irregular boundary; change downward to dark, dense, burrowed dolomite, then to dark biosparite at 12031 -- at 12032 - medium-brown, slightly dolomitic, current-streaked, miliolid and clast biosparite and intrasparite -- at 12037 - becomes non-dolomitic, otherwise as above -- at 12040 - becomes wispy and burrowed -- at 12041-46 - increasingly dolomitic, terminating in thin, dark, totally dolomitized crust	

Depth (feet)		Thickness (feet)
	-- at 12046 - abrupt change back to miliolid-clast, muddy biosparite with current streaks; dolomitic in top foot	
	-- at 12049-53 - flat, mollusc shells and coated clasts	
	-- at 12053 - change back to dolomitic, miliolid and clast biosparite and biomicrite, becoming muddier, more burrowed, more dolomitic, with more shells below	
	-- at 12060-63 - stylolite boundary, change downward to dark grayish-brown, very coarse, very angular, dolomite breccia	
	-- at 12063-71 - abrupt boundary; change to dolomitized, burrowed, wispy, oyster and pellet biomicrite, almost totally dolomite in upper part, becomes strongly dolomitic again at 12067-68 and 12069-71	
	-- at 12071 - abrupt undulose carbonaceous streak, change to dark-gray, massive dolomite shot through with spar-filled cracks (collapse?)	
	-- at 12073-76 - fantastic collapse-breccia, totally dolomitized, with superb IIIC/D porosity; most fragments are crusts or channel deposits; lower boundary is abrupt	
	-- at 12076-78 - dark-gray, evenly- and finely-laminated dolomite, either storm layers or even stromatolites	86
	Remarks: a. Twelve-foot shell bank in Regional Dense Member. b. Superb porosity in dolomitized, leached, collapse zones in both Person and Kainer Formations. c. Well-developed, supratidal structures. d. Core depths 10' low to log depths.	

KARNES COUNTY, HUMBLE, NO. 1 COCHRAN (15), DAVY FIELD

EDWARDS GROUP
PERSON FORMATION
Cyclic Member--

11010-11014	1. Limestone: dark-brown, whole-mollusc biomicrite; IA; shells are gastropods and oysters, replaced by sparry calcite....	4
11014-11020	2. Limestone: medium-brown, burrowed (in part), laminated (in part), microsparite; I/IIIA.....	6
11020-11025	3. Dolomite: light-gray, fine-crystalline, burrowed and churned, dolomitized micrite; I/IIIA.....	5
11025-11057	4. Calcitic dolomite: medium- to dark-brown, fine-crystalline; IIIA/B; generally featureless, few visible burrows, some staining. -- at 11034-37, 11040-48 - discrete burrows can be made out -- at 11037-40 - clasts; flat, crinkly, hard crusts -- at 11048 - dolomite drops out, rock is more intensely burrowed -- at 11,055-57 - interval of dense dark micrite with black, chert nodule.....	32

Marine Member--

11057-11096	5. Limestone: light grayish-brown, burrowed, mollusc-fragment biomicrite; IA; shells occur as medium-sized fragments scattered through matrix. -- at 11060-68, 11069-96 - becomes light gray-brown, with common shells -- at 11068-69 - Toucasia shells abundant -- at 11079-88 gap.....	39
11096-11099	6. Limestone: light-gray, coarse-grain, mollusc-fragment biosparite; IIIB; rock appears to have been leached and altered, then chertified in part; dead oil at 11099.....	3
11099-11108	7. Limestone: light grayish-brown, fine-grain, mollusc-fragment and soft-pellet biomicrite; IA/B; slightly burrowed in part, some few wispy structures.....	9
11108-11112	8. Limestone: light-gray, thoroughly burrowed, rudist biomicrite and biosparite; IA; large rudists, most abundant at 11110-12.....	4
11112-11117	9. Limestone: much as unit above, but shells drop out, burrowing continues, featureless, very dolomitic in lower 1-1/2 feet	5

Leached Member--

11117-11119	10. Dolomite: medium-gray, dolomitized micrite with angular, sparry areas; IIIA/B; this is a collapse breccia with angular fragments and calcite in-filling.....	2
11119-11160	11. Calcitic dolomite: medium-brown, highly burrowed and churned, dolomitized micrite and biomicrite; IIIB; few scattered, thin, collapse zones; scattered shells.....	41
11160-11170	12. Limestone: medium- to dark-gray, burrowed, oyster biomicrite; IA; very slightly dolomitic in part.....	10

Collapsed Member--

11170-11174	13. Dolomitic limestone: dark-gray, dolomitic micrite, IIIA; burrowed in part, dolomite scattered; similar to unit above, without shells, more dolomite.....	4
11174-11175	14. Collapse breccia: pebbles angular, leached, medium grayish-brown dolomite; voids filled with (1) gilsonite, (2) sparry calcite.....	1
11175-11177	15. Limestone: dark-brown, thoroughly burrowed and churned micrite; IA.....	2
11177-11194	16. Calcitic dolomite: medium brownish-gray, very coarse, stromatolite-and micrite-clast intramicrite; IIIA/B, clasts very angular, note general lack of arrangement; few good hard layers, particularly one at top of interval and again at 11185 (chertified); rock at 11185 important because it suggests chert forms penc-contemporaneous with limestone and forms in response to exposure surfaces; some evidence toward bottom of collapse-brecciation.....	17
11194-11205	17. Dolomite: medium-to dark-brown, thoroughly churned, dolomitized, soft-pellet intramicrite; IIIB; generally featureless, most texture obliterated.....	11

KARNES COUNTY; TENNECO, NO. 1 COCHRAN (13); DAVY FIELD

GEORGETOWN FORMATION

11048-11050	1. Limestone: dark-brown, dense, hard micrite; IA; scattered Globigerina and calcispheres; flat-pebble streaks throughout interval, also carbonaceous streaks.....	2

EDWARDS GROUP
PERSON FORMATION
Cyclic Member--

11050-11065	2. Limestone: dark-brown, dense, hard, miliolid biomicrite; IA; rock thoroughly burrowed and churned with intermittent intervals of medium-size gastropod shells; few small rudistids; upper boundary abrupt, irregular, with 1"-2" layer of flat-pebble conglomerate immediately above; this layer also truncates a spar-filled fracture, the upper 1" of which is plugged with mud and which contains mud clasts "floating" in the spar; almost certainly represents an exposure surface. -- at 11059-65 - large mollusc shells, few rudistids.....	15
11065-11071	3. Dolomitic limestone: medium grayish-brown, fine- to medium-crystalline, homogeneous, dolomitic, pelleted micrite IIIA/B.....	6
11071-11094	4. Dolomitic limestone: dark brownish-gray, thoroughly burrowed, dolomitic, pelleted micrite; IIIA/B. -- at 11090-94 - non-dolomitic.....	23
11094-11276	5. Gap.....	182

KAINER FORMATION
Grainstone Member--

11276-11286	6. Limestone: medium grayish-brown, medium- to coarse-grain, well-sorted, miliolid biosparite; IIIA/B; well-winnowed for the most part; this is definitely an interior platform sand body, where the available sand grains are almost exclusively miliolids.....	10
11286-11288	7. Limestone: very dark-gray, carbonaceous, fissile, shelly (Chondrodonta) micrite; IA.....	2
11288-11307	8. Dolomitic limestone: medium grayish-brown, medium- to coarse-grain, medium-crystalline, dolomitic, miliolid biosparite; IIIA/B, with IIIB porosity at 11305-07.....	19
11307-11311	9. Limestone: dark brownish-gray, whole-mollusc micrite; IA/B; molluscs are Chondrodonta and/or oysters..... Remarks: Georgetown-Edwards boundary is clearly disconformable in this core.	4

KARNES COUNTY; TENNECO, NO. 1 HARPER (22); JOHN RANDON SURVEY, A-247

GEORGETOWN FORMATION

10928-10940	1. Limestone: medium to dark grayish-brown, dense, pyritic, clayey, mollusc and calcisphere biomicrite; IA; note some wispy structures, also burrowing; becomes more wispy and argillaceous downward; fragile, fine-molluscan debris scattered throughout; pyrite disseminated; Globigerina scattered.....	12
10940-10944	2. Limestone: intermixed, medium-brown, Globigerina, mollusc-fragment biomicrite and darker, wispy, argillaceous micrite similar to unit 1; IA; this is a peculiar rock; I cannot tell whether the alternating lithic types are due to (1) simple interbedding; (2) severe burrowing in semi-indurated sediment; (3) large clasts not fully hardened; at any rate, the boundaries are discrete and very irregular with some definite burrowing; some are almost certainly weathered pebbles; this may be a basal conglomerate; Globigerina much more abundant than in unit 1; lower boundary is very sharp. Compare this unit with equivalent in Shell, Urbanczyk No. 2.....	4

Depth (feet)		Thickness (feet)
	EDWARDS GROUP PERSON FORMATION Cyclic Member--	
10944-10949	3. Limestone: medium-brown, foram-mollusc biomicrite; IA; miliolids, Dictyoconus scattered; also scattered flat clams and caprinid molds now filled with sparry calcite; upper boundary is sharp, undulose (3/4" relief), upper 1/2" of Edwards rock pyritized, weathered; laminated chert and pyrite band (looks almost stromatolitic)lying on Edwards.....	5
10949-10955	4. Limestone: light grayish-brown, well-sorted, fine-grain, mollusc-fragment biosparite; IA; scattered pellets or small lithoclasts; some broken mollusc shells, miliolids, some finely-coated grains; several large stylolites; basically the same as unit above without large shells.....	6
10955-10958	5. Limestone: essentially as above, with scattered large shells (radiolites), Toucasia, caprinids, and Cladophyllia. -- at 10955 - large (1/4" across) inclined fracture filled with sparry calcite and gilsonite; also large 2" sparry area filled with gilsonite -- at 10957.5 - definite thin (3") collapse breccia filled with sparry calcite and gilsonite, still in the fossil rock.....	3
10958-10971	6. Limestone: medium to dark grayish-brown, wispy, churned, miliolid and mollusc-fragment biomicrite; IA; abundant vertical fractures have broken core up badly; unit differs from rock above by having wispy structures; darker color, common miliolids, scattered pellets and clasts. -- at 10959-60 - very wispy; these are short, finely-disseminated wisps -- at 10960 - thin (1/2") contorted, brown chert layer; becoming darker -- at 10960.5 - large (1/2"-2") rounded, miliolid micrite clasts in wispy micrite matrix, not a collapse zone -- at 10961-64 - becomes dark-brown; still clasts in miliolid micrite matrix -- at 10964-70 - becomes much less wispy, less fossiliferous micrite with thin zone of angular clasts at base (core broken, most fragments dolomite) -- at 10970 - sequence terminates in 6" light-gray dolomite stromatolite with chert nodule (replaced anhydrite?) above and 4" zone of clasts below; this is a distinct cycle base.....	13
10971-10975	7. Gap.....	4
10975-10984	8. Limestone: dark-brown, dense, homogeneous, burrowed, pelleted, mollusc-fragment micrite; IA. -- at 10978-81 - gap -- at 10981-84 - as above, highly burrowed -- at 10984 - anhydrite, medium- to light-gray, with undulose bands..... Remarks: Tenneco, Harper No. 1 was drilled in the thickest (deepest water?) part of the Karnes Trough north of the Person Field. The core is significant because it contains bedded anhydrite that can be correlated into a collapse breccia zone in several wells on the Person Field horst-block (the highest or shallow water part). This indicates that the collapse structures are due to removal of anhydrite and furthermore that the removal was a function of exposure and leaching by meteoric or normal marine water, probably during Edwards deposition.	9

KARNES COUNTY; SHELL, NO. 1 HYSAW GAS UNIT 2 (48); HYSAW (EDWARDS) FIELD

	GEORGETOWN FORMATION	
11072-11111	1. Limestone: medium to dark brownish-gray, dense, argillaceous, fossiliferous micrite; IA; scattered pelagic forams, calcispheres, glauconite, pyrite; small, fragile, shell fragments; common wispy structures and burrows. -- at 11091-92 - gap -- at 11094-100 - more homogeneous, almost no carbonaceous wisps or burrows -- at 11108-10 - gap -- at 11111 - Georgetown-Edwards contact is abrupt and undulose (1/2" relief on surface); contact truncates shells in Edwards; pyrite layer 1/8" thick, "cruddy" zone of organic-rich granular material about 1/2" thick above contact; below contact are small "caves" in Edwards filled with granular pellet material containing Globigerina.....	39
	EDWARDS GROUP PERSON FORMATION Cyclic Member--	
11111-11125	2. Limestone: medium- to dark-brown, poorly-sorted, pelleted, mollusc biomicrosparite; I/IIIA; shells are Chondrodonta, Toucasia, small oysters, caprinids, also scattered miliolids; shells less abundant, rock darker at 11119-25; lower boundary gradational within 2".....	14
11125-11127	3. Limestone: light- to medium-gray, very coarse-grain, moderately-sorted, mollusc-fragment biosparite; IIIA/B, porosity mostly unconnected; shell fragments appear leached, then in-filled with spar; microspar occupies former micrite areas; rock fabric has definitely been altered; lower boundary abrupt.....	2
11127-11129	4. Limestone: medium- to very dark-brown, dense, burrowed, very fine pelleted microsparite; I/IIIA; burrows are elongate parallel with bedding, appear filled by slightly coarser-grain sediment; matrix in general homogeneous; lower boundary gradational within 2". -- at 11128 - dense, dark-gray chert nodule 2" thick; very evenly-and finely-laminated micrite immediately beneath....	2
11129-11174	5. Limestone: dark-brown, pelleted, mollusc-shell biomicrite much as 11111-25, except darker. -- at 11133-41 - gap -- at 11145-54 - larger shells drop out, rock mostly very fine-grain, pelleted biomicrite, with some fine, even laminations, disrupted locally by burrows -- at 11146 - 2" dark-gray chert nodule -- at 11147 - chambered shells, filled-in with rock matrix, then shell wall was removed, filled-in with spar -- at 11154-64 - shells resume, mostly snails and small oysters (shell material all spar-replaced) -- at 11164-67 - shells mostly gone -- at 11167-71 - note influx of large Chondrodonta in matrix of above, but thoroughly burrowed; rock dolomitized at at 11169-71, particularly burrows, but porosity poor (IIIA); at 11170.5 note also 4" streak of light-gray, coarse-grain, mollusc-fragment biosparite completely replaced by chert and chalcedony; this bed has stylolite boundaries above and below; dolomitic zone has no evidence of supratidal features or exposure.....	45
11174-11178	6. Limestone: light-gray, coarse-grain, mollusc biosparite, similar to 11125-27, some scattered vugs (IIIC, unconnected pores); some small white chert rosettes; lower boundary abrupt.....	4
11178-11180	7. Limestone: very dark-gray, dense, very fine-grain, well-sorted, pelleted, fragile mollusc biomicrite; IA; laminated at base..... Remarks: Although made up almost entirely of limestone, this core has a single 2-foot zone of burrowed, dolomitized micrite bearing large whole oysters. It has no features indicative of supratidal environment or of exposure. Where did the dolomitic come from? In the absence of sedimentary structures indicative of the supratidal realm, we obviously cannot rely on supratidal processes or on exposure; nor can we explain it away by saying that it became dolomitized long after the rock was hard, for of this entire core, only this zone bears dolomite. Inspection of the rock suggests strongly that distribution of the dolomite is in some way related to burrowing. This suggests very early dolomitization--while the burrows were open or perhaps even while they were being made. Beds equivalent to this were formed in the supratidal realm only five miles away at Person Field, which suggests some kind of reflux action may take place on a small bed-by-bed scale where (1) dolomitized waters form in supratidal sediments and sink down; (2) then flow through more porous, still-soft sediments down-slope from the tidal flat to shallow marine sediments.	2

KARNES COUNTY; SHELL, NO. 2 KAINER (3); PERSON FIELD

	EDWARDS GROUP PERSON FORMATION Regional Dense Member--	
10785-10791	1. Argillaceous limestone: dark brownish-gray, hard, dense, wispy and burrowed, argillaceous micrite; IA, few scattered streaks of dolomite and pyrite; lower boundary not present in cores.....	6
	KAINER FORMATION Grainstone Member--	
10791-10902	2. Limestone: light grayish-brown, medium- to coarse-grain, generally well-sorted, miliolid biosparite and intrasparite, IA; intraclasts are pellets and ragged, coated, recrystallized aggregates of miliolids in both sparry and micritic matrix that appear weathered.	

Depth (feet)		Thickness (feet)
	-- at 10812-58 - gap -- at 10858-97 - scattered patches of dolomite -- at 10862-64 - very coarse-grain intramicrite, many clasts with weathering rinds, many recrystallized -- at 10898 - thin streak of light grayish-brown, coarse-crystalline dolomite	111
	Dolomitic Member--	
10902-10980	3. Dolomitic limestone: dark grayish-brown, fine- to medium-grain, fine- to medium-crystalline, dolomitic, miliolid and mollusc-fragment biosparite and muddy biosparite, IIIA, other features: -- at 10904 - crystalline celestite -- at 10911-14, 10925-60 - gaps -- at 10914 - caprinid fragments -- at 10921-22 - dark-brown micrite -- at 10960-75 - grades to coarse-grain biomicrite and intramicrite with coated clasts and mollusc fragments	78
10980-10988	4. Celestite: white to clear, very coarse-crystalline, layered celestite	8
10988-11026	5. Dolomite: medium-gray to dark-brown, fine-crystalline dolomitized micrite and mollusc-fragment biomicrite, IIIA/C, other features: -- at 11001-02, 11017-26 - stromatolitic layers, partly or wholly collapsed and brecciated, with associated disrupted micrite, and cracks filled with white anhydrite -- at 11023 - white anhydrite nodule	38
11026-11057	6. Dolomitic limestone: medium brownish-gray, fine- to medium-grain, pelleted, dolomitic, muddy, foram biosparite and biomicrite; I/IIIA; current streaks and muddy patches, forams are Dictyoconus and miliolids. -- at 11028 - dolomite occurs around peripherics of well-sorted, fine-grain pellets and micrite intraclasts, some dead oil in grain interstices -- at 11030-32, 11037-41, 11056-57 - gaps -- at 11050-51 - oyster fragments -- at 11051-54 - medium-gray, massive, homogeneous, medium-crystalline dolomite, with abundant dead oil -- at 11053 - anhydrite crystals fill fractures	31
11057-11091	7. Dolomite: medium grayish-brown, medium- to fine-crystalline, generally massive, burrowed, dolomitized micrite, IIIA/B -- at 11061-69, 11072-78, 11082-84, 11088-91 - gaps -- at 11069-72 - Dictyoconus, oyster shells scattered through micrite with anhydrite-filled cracks -- at 11074-81 - disrupted zone with anhydrite nodules -- at 11084-88 - scattered dolomite rhombs in dark-brown, laminated micrite	34
11091-11134	8. Dolomitic limestone: dark brownish-gray, medium-grain, muddy, miliolid biosparite and intrasparite, IA/B, intraclasts are pellets and miliolid aggregates, many with pseudo-oolitic coats; some dead oil stain, unit becomes more dolomitic below 11112; other features: -- at 11103 - anhydrite nodules -- at 11108 - oyster-shell fragments -- at 11111 - stylolite -- at 11132-34 - gap	43
11134-11142.5	10. Limestone: medium brownish-gray, fine- to medium-grain, well-sorted, miliolid biosparite, I/IIIA, scattered mollusc-fragments, many with thin coats; some rounded micrite pellets. -- at 11134-37.5 - muddy streak with dark-gray chert nodule and anhydrite-filled cavities -- at 11137.5-41 - Toucasia	8.5
11142.5-11161	11. Dolomitic limestone: dark to medium grayish-brown, fine- to medium-grain, pelleted, dolomitic, mollusc-fragment and miliolid biomicrite and biosparite. -- at 11141-48 - anhydrite nodules, partly replaced by chert -- at 11144-47 - burrowed -- at 11148-50, 11152-54 - gray, medium-crystalline, homogeneous dolomite -- at 11154-57 - few shell fragments with pseudo-oolitic coats	18.5
11161-11193	12. Dolomitic limestone: medium-brown to brownish-gray, hard, dense, poorly-sorted, wispy, burrowed, mollusc-fragment and miliolid micrite and biomicrite; IIIA/B; dolomite concentrated in burrows. -- at 11167 - small white chert patches in shell fragments -- at 11170 - large calcite pseudomorph after gypsum nodule -- at 11187 - white anhydrite nodules associated with burrows	32

KARNES COUNTY; SHELL, NO. 1-A KRUCIAK (9); PERSON FIELD

EDWARDS GROUP

PERSON FORMATION

	Cyclic Member--	
10728-10734	1. Limestone: medium-brown, dense, pelleted, mollusc biomicrite and intramicrite; mostly IA; abundant calcite-filled areas, large mollusc shells, mud clasts, and a few miliolid mud areas all mixed up together; note disseminated rusty microsparite patches scattered throughout; abrupt boundary with underlying unit	6
10734-10748	2. Limestone: medium-brown, "wispy", oyster biomicrite; I/IIIA, rusty interstitial microspar of above continues; oysters become much less abundant from 10739-48; grades downward into next unit	14
10748-10753	3. Limestone: dark-brown, dense, burrowed and churned micrite; IA; scattered micrite clasts are more angular and discrete above, becoming vague and rounded below; grades downward into next unit	5
10753-10758	4. Calcitic dolomite: medium grayish-brown, medium-crystalline, dolomitized micrite; IIIB; burrowed and churned above, grading downward to very angular, coarse collapse breccia below	5
10758-10760	5. Limestone: dark-brown, dense, evenly-laminated, oyster biomicrite; IA; evenly-undulose bedding	2
10760-10784	6. Dolomitic limestone: medium-brown, featureless, medium-crystalline, dolomitic micrite; IIIA/B; in general becomes less dolomitic downward; distinctly burrowed and churned with oysters at 10765-66, clasts at 10766-67, and oysters at 10770-80; oysters drop out below 10780, burrowed and churned structure continues though less well developed. -- at 10760.5 - dessication cracks -- at 10766.5, 10771 - thin collapse breccia -- at 10781 - distinct hard crust	24
	Marine Member--	
10784-10788	7. Limestone: medium-brown, dense, burrowed and churned, pelleted, foram biomicrosparite; I/IIIA; rusty interstitial microspar present; note miliolids, remnants of Dictyoconus; grades into unit below	4
10788-10803	8. Limestone: medium-brown, mollusc-shell biomicrosparite; IIIA/B; silty, rusty microspar matrix, some white chert in small (1/8"-1/4") rosettes; molluscs are mostly oysters and flat clams; dolomitic in lower 3 feet	15
10803-10815.5	9. Limestone: medium-brown, dense, wispy, pelleted microsparite; I/IIIA; common rusty microspar continues; vaguely burrowed and churned at 10810, dark-gray chert nodule at 10812; three graded beds 1" thick at base of interval; stylolite boundary with unit below	12.5
10815.5-10834	10. Limestone: medium-brown, very wispy, mollusc biomicrosparite; I/IIIA; allochems and fragments of flat clam shells and oysters; at 10828-29 6" lump of calcite--recrystallized coral head; some fossil fragments replaced by chert; dolomite abundant about 10825	18.5
	Leached Member--	
10834-10870	11. Dolomite: medium brownish-gray, medium-crystalline, thoroughly dolomitized, churned and burrowed micrite; IIIB; somewhat less dolomitic and darker brown from 10840-46; at 10840.5 note distinct bladed crystals filled with calcite--replaced dolomite rhombs(?) or calcite-filled gypsum crystals(?); distinct large lumps and burrows at 10849; anhydrite in calcite crystals at 10851. -- at 10840-46 - somewhat less dolomitic and darker brown -- at 10840.5 - distinct bladed crystals filled with calcite; calcite pseudomorphs after gypsum -- at 10846 - distinct calcite-filled collapse breccia -- at 10849 - large lumps and burrows -- at 10857 - anhydrite in calcite crystals	36
10870-10883	12. Dolomitic limestone: very dark-brown, dense, intensely churned and disrupted, in part dolomitic micrite; I/IIIA; dolomite most abundant at 10876-79. -- at 10879-83 - mud-filled collapse breccia with broken crusts	13
	Collapsed Member--	
10883-10886	13. Dolomite: light to medium brownish-gray, medium-crystalline, thoroughly dolomitized, mollusc-fragment micrite; IIIB, gilsonite in vugs at 10885	3
10886-10892	14. Limestone: dark-brown, dense, laminated micrite; IA; distinct layered and laminated structure, probable hard crust at 10888, with graded bedding below	6
10892-10896.5	15. Dolomite: light grayish-brown, medium-crystalline, dolomitized micrite breccia; IIIB, particles up to 2", very angular, mixed up, grades downward to burrowed and churned micrite in lower 2 feet	4.5
10896.5-10910	16. Dolomite: medium brownish-gray, homogeneous, medium-crystalline, thoroughly dolomitized micrite; IIIB, vague burrowing at 10903-10; excellent porosity at 10897-900; note calcite vein-filling at 10900	3.5

Depth (feet)		Thickness (feet)
10910-10980	17. Gap	70
	KAINER FORMATION	
	Grainstone Member--	
10980-10985	18. Limestone: dark-brown, very dense micrite; IA; rich in disseminated organic matter, with few mollusc shells, few brown blobs of mud--burrows(?)	5
10985-11015	19. Gap	30
11015-11032	20. Limestone: light grayish-brown, dense, well-sorted, medium-grain, miliolid biosparite; IA; distinct horizontal current streaks; becomes slightly coarser-grain at 11023.5, muddy streak at 11029, slightly porous from 11029-32 (I/IIIA/B)	17
	Dolomitic Member--	
11032-11049	21. Dolomitic limestone: medium brownish-gray, medium-grain, fine- to medium-crystalline, variably dolomitized, miliolid and mollusc-fragment biomicrite; IIIB, porosity excellent, particularly at 11041-49 where miliolids apparently got leached out in dolomitization process; becomes muddier at 11041-45; note larger shell debris at 11045; muddier again at 11046-49; dolomite most abundant at 11046-49--good oil-stain here also	17
11049-11051	22. Limestone: dark-brown, dense, wispy, pelleted, slightly dolomitic micrite; IA; rare molluscs and miliolids	2
11051-11061	23. Dolomitic limestone: essentially as at 11032-49; oil-stained, rock most dolomitic and porous from 11057-61--change in lower part of this unit duplicates similar change in unit 21	10
11061-11063	24. Limestone: dark-brown, slightly dolomitic micrite similar to unit 22, grades into unit below	2
11063-11069	25. Dolomite: medium grayish-brown, essentially homogeneous, medium-crystalline dolomite; IIIB; excellent porosity; this rock probably originated as miliolid biomicrite and muddy biosparite, subsequently completely dolomitized	6
11069-11071	26. Dolomite: medium grayish-brown, coarse, angular, brecciated, dolomitized micrite and burrowed and churned micrite, similar to 11063-69; thin oil-stained intervals at 11069-71	2
11071-11075	27. Limestone: light- to medium-brown, slightly dolomitic, miliolid intramicrite; IA; intraclasts are soft-pellets; dolomite occurs in burrow-fillings	4

KARNES COUNTY; MORGAN MINERALS, NO. 1 J. PAWELEK (23); F. CARILLO 8 SURVEY, A-64

	BUDA LIMESTONE	
9655-9747	1. Limestone and shale: medium grayish-brown, dense, slightly pyritic, in part argillaceous, calcisphere and Globigerina micrite, alternating with dark-gray, compact, carbonaceous, calcareous, very pyritic shale; IA; shaly streaks at: 9655-67, 9660-61, 9685-86, 9698-99, 9711-13, and 9739; scattered mollusc shells; burrows at 9680; fish scales at 9741.	92
	DEL RIO CLAY	
9747-9754	2. Shale: very dark brownish-gray to reddish-black, dense, granular, carbonaceous, pyritic, calcareous shale; IA; not notably fissile; upper contact gradational from 9739-47; shale grades to argillaceous limestone in places	7
9754-10001	3. Gap	247
	EDWARDS GROUP	
	PERSON FORMATION	
	Cyclic Member--	
10001-10005	4. Calcitic dolomite: medium grayish-brown, burrowed, dolomitized micrite and intramicrite; IIIA, sequence non-dolomitic in upper foot, completely dolomitized at 10003-05; -- at 10004-05 - distinct but rather fine-grain collapse or churned fill--pebbles rounded somewhat, non-dolomitic; matrix dolomitic	4
10006-10011	5. Limestone: medium- to dark-brown, dense, mollusc-fragment and miliolid biomicrite; IA; another reworked mud-filled collapse at 11008-10 (some clasts are light-gray dolomite); numerous stylolites throughout	5
10011-10015	6. Limestone: light to medium grayish-brown, fine-grain, poorly-sorted, miliolid and Toucasia biomicrite; IA; Toucasia shells occur as fairly large, broken fragments; finer-grain downwards	4
10015-10029	7. Limestone: light-brown, dense, fine-grain, whole-mollusc biomicrite and micrite; IA; mostly mollusc fragments up to 1/2" across. -- at 10020-21 - rounded clasts of very light-brown limestone scattered throughout	14
10029-10045	8. Dolomite: medium to dark brownish-gray, massive, burrowed, dolomitized micrite; IIIA/B; upper contact gradational within 2 feet. -- at 10034-35 - large, flat, laminated, light-gray broken clast; probable crust -- at 10035-36 - distinct, very coarse-grain, very angular collapse breccia with mud in-fill -- at 10037 - small calcite veinlets -- at 10039 - burrowed, with a few small mollusc shells -- at 10040 - few more shells; some leached; calcitic dolomite matrix -- at 10041-43 - slightly dolomitic, medium-brown, mollusc biomicrite; few large oysters -- at 10043 - current-laminated dolomitized micrite	16
10045-10050	9. Limestone: very dark-brown, dense, slightly dolomitic, micrite; IA; few vague, small pellets scattered throughout	5
10050-10060	10. Dolomitic limestone: medium-brown, very fine-grain; slightly dolomitic, mollusc-fragment biomicrite; IA; note few pellets and soft clasts, also very dark, shaly carbonaceous streaks. -- at 10053 - small black chert nodules -- at 10054 - becomes burrowed calcitic dolomite -- at 10058 - rounded clasts and areas of white calcite -- at 10059 - oyster shells	10
	Marine Member--	
10060-10081	11. Limestone: medium to light brownish-gray, coarse- to medium-grain, mollusc-fragment biosparite; IC; porosity developed as small, often unconnected vugs. -- at 10061 - scattered microspar in-filling, some vugs; many pores are leached shells -- at 10066 - becomes fine-grain -- at 10068 - scattered Toucasia fragments -- at 10071 - very slightly dolomitic--scattered rhombs -- at 10072-75 - banded brown 3" chert nodules -- at 10075-81 - scattered dolomite rhombs becoming more abundant downward so that rock at 10078-81 is calcitic dolomite; note black chert nodule at 10080-81	21
10081-10143	12. Gap	62
	Collapsed Member--	
10143-10155	13. Limestone: dark-brown, dense, pelleted, fine skeletal micrite; IA; becomes dolomitic downward. -- at 10145-46 - medium to dark brownish-gray, poorly-sorted, medium-grain, dolomitized intramicrite; intraclasts are rounded micrite clasts and soft-pellets -- at 10149-52 - very pure, dense micrite -- at 10154-55 - light-brown, rounded clasts	12
10155-10173	14. Calcitic dolomite: medium to dark brownish-gray, massive, burrowed, pelleted, dolomitized micrite; IIIA/B. -- at 10161-62 - mud-filled collapse or soil rubble--some clasts look like former hard crusts, some rounded -- at 10164-65 - dark-gray, with wispy streaks -- at 10168-69 - dark-gray -- at 10171 - burrowed	18
10173-10178	15. Limestone: medium-brown, dense, poorly-sorted, burrowed, mollusc biomicrite and micrite; IA; few soft clasts in lower part	5
10178-10280	16. Gap	102
	KAINER FORMATION	
	Grainstone Member--	
10280-10304	17. Limestone: light to medium grayish-brown, medium-grain, well-sorted, muddy miliolid biosparite; IIIB; current streaks at 10290; porosity is intergranular, particularly below 10929	24

KARNES COUNTY; BRAZOS, NO. 1 PERSON (5); PERSON FIELD

	EDWARDS GROUP	
	PERSON FORMATION	
	Cyclic Member--	
10804.5-10806	1. Dolomitic limestone: medium grayish-brown, dense, burrowed, dolomitic dismicritic; IIIA; burrowing appears as vaguely angular, lath-like disruption pattern; patches of sparry calcite fill what looks like fractures formed while sediment was gelling	1.5

Depth (feet)		Thickness (feet)
10806-10813	2. Dolomitic limestone: dark brownish-gray, dense, coarse-grain, muddy intrasparite, IIIA; clasts are large (1/16"-2"), consist of medium-brown, pelletoidal micrite with a few miliolids, clasts were apparently hard, for although many appear squashed, with rounded corners, they have discrete boundaries, some clasts appear as current-laminated, very fine-grain biomicrite and micrite, as at 10806.5; few large shell fragments in matrix of dark micrite; becomes muddier, more disrupted downward. -- at 10807.5 - large, evenly-laminated micrite clast	7
10813-10829	3. Gap	16
10829-10835	4. Dolomite: medium grayish-brown, thoroughly burrowed and disrupted, dolomitized micrite and intramicrite; IIIA, common small fractures. -- at 10833 - note small vertical fractures, large clast (or 6" bed of burrowed dolomitic micrite) -- at 10834-35 - very dark brownish-gray, mollusc-fragment, dolomitized biomicrite and dense, black, bedded, fragment of chert	6
10835-10849	5. Calcitic dolomite: dark grayish-brown, burrowed, dolomitized, oyster biomicrite, IIIA/B; dolomite occurs as rhombs concentrated erratically; in lower half of interval, note remnants of irregular laminae, half destroyed by churning. -- at 10838.5 - rock becomes less laminated, less burrowed, generally featureless dolomite, with scattered small spar-filled shell fragments -- at 10846-49 - black, carbonaceous, irregularly and thickly laminated, oyster biomicrite; in lower part rock grades to highly disrupted, coarse, rounded-clast intramicrite	14
	Marine Member--	
10849-10854	6. Limestone: medium-brown, thoroughly burrowed, wispy micrite, IA; scattered coral fragments (Cladophyllia), chert occurs as light brownish-gray, rounded, 1/2" masses of replaced skeletal limestone	5
10854-10878	7. Gap	24
	Leached Member--	
10878-10916	8. Calcitic dolomite: medium-brown to brownish-gray, burrowed, wispy, fine-crystalline, dolomitized micrite and biomicrite; IIIA/B, numerous small gradations downward as follows: -- at 10879 - light grayish-brown chert nodules and gastropods -- at 10883 - becomes somewhat more wispy, with oysters at 10884, this rock continues to change gradually from grayish-brown to brownish-gray--gradation at 10889-94 -- at 10899-02 - large patches of sparry calcite, calcite in-fills of former anhydrite nodules? -- at 10905-07, 10912-16 - incipient breccias now spar-filled -- at 10908-09 - concentration of very fine wispy structures -- at 10916 - sequence ends abruptly	38
	Collapsed Member--	
10916-10957	9. Calcitic dolomite: dark to light grayish-brown, heterogeneous, generally wispy and burrowed, dolomitized, oyster and gastropod biomicrite and intramicrite; generally IIIA/B; changes as noted: -- at 10916-20 - oysters, chert-replaced in upper half, spar-replaced in lower half -- at 10925.5-27.5 - intramicrite with clasts composed of white limestone in burrowed, shelly micrite matrix -- at 10927.5-30.5 - dolomitized, spar-filled collapse breccia -- at 10932-38.5 - micrite, gastropod biomicrite and intramicrite as thin alternating beds; apparently cycles of deposition, perhaps related to channel-filling -- at 10938.5-54 - generally homogeneous dolomitized micrite -- at 10945 - spectacular collapse structure	41
	Regional Dense Member--	
10957-10980	10. Limestone and dolomitic limestone: dark grayish-brown, dense, pyritic, burrowed, wispy, partly-dolomitic, mollusc micrite and biomicrite; IA; molluscs are mostly very fine, fragile, whole clam shells and some oysters; some areas of pelleted micrite. -- at 10957 - sequence of dolomitization in and around burrows; micrite matrix grades to fine-crystalline, dolomitic micrite near burrow, to dark-brown, medium- to coarse-crystalline dolomite burrow-fills -- at 10972 - lithology of above continues--note first very small clasts of miliolid agglomerates similar to those in underlying Grainstone Bed of Kainer Member -- at 10979-80 - coarse clasts of light-brown miliolid biosparite and a few chert-replaced oyster fragments -- at 10980 - boundary at top of Kainer is irregular with 1/4"-1/2" undulations, overlain continuously with 1/8"-1/4" layer rich in organic matter and pyrite; sharp lithic charge at 10980	23
	KAINER FORMATION	
	Grainstone Member--	
10980-11024.5	11. Limestone: light-brown, medium-grain, moderately-sorted miliolid biosparite and intrasparite; IIIA; some miliolids with coats; clasts are aggregates of mud, miliolids and shell debris; common current streaks and laminae, and scattered micrite streaks; note sucrosic calcite scattered throughout--recrystallized or altered allochems(?). -- at 10981 - large oyster fragments -- at 10989-92 - large irregular mud clasts -- at 10994-98.5 - fine-grain, miliolid and mollusc-fragment biosparite--note some current streaks, also horizontal muddy streaks -- at 11010-11 - large flat, miliolid biomicrite clasts -- at 10023-24.5 - light grayish-brown skeletal intramicrite; large coated clasts--some up to 1/2" diameter; note Cladophyllia-type corals, oysters, algae; matrix consists of silt-size miliolid, skeletal, and pelletal material	44.5
11024.5-11030.5	12. Limestone: light grayish-brown to medium-brown, coarse-grain, whole-mollusc biomicrite; IA, Chondrodonta, Eoradiolites shells are large and common; note chert replacements of shell that resemble pisolite-like rosettes; lower 3 feet contains small rounded micrite clasts	6
11030.5-11061	13. Limestone: medium- to dark-brown, pelleted, miliolid biosparite; I/IIIA/B; dead oil in pores at top; minor changes below as noted: -- at 11032-36.5 - faintly stratified and bedded, becomes muddy with small tan mud clasts (1/16") and miliolids; coarsely dolomitic in lower foot; stylolite at base -- at 11037 - abundant dasyclads -- at 11054-55 - dolomite rhombs scattered through matrix of muddy biosparite	30.5
11061-11074	14. Gap	13
11074-11095	15. Dolomitic limestone: medium to dark grayish-brown, fine-grain, well-sorted, pyritic, dolomitic, miliolid and mollusc-fragment biomicrite and muddy biosparite; III/B; scattered clasts; intervals of coarse debris at 11078O-80, 11089-91, 11094-95; possible worm tubes at 11078.5; total interval with brown sucrosic calcite, best developed in coarse-grain areas; bottom 6" with oysters; abrupt lower boundary	21
	Dolomitic Member--	
11095-11097.5	15. Calcitic dolomite: very dark-gray to dark-brown, medium- to coarse-crystalline, dolomitized, coarse intramicrite; IIIA; clasts are 1/4"-1", rounded, vaguely concentric incipient pisoliths(?); matrix has vague burrowed texture	2.5
11097.5-11112	17. Dolomite: medium to dark grayish-brown, fine- to medium-crystalline, well-sorted, dolomitized pellet and foram biosparite and intrasparite; IIIA/B; horizontal laminations at 11098, 11099, 11101, 11110, 11111. -- at 11098 - oysters and coarse clasts -- at 11100-12 - extensive dolomitization -- at 11106 - sparry calcite patches	14.5
11112-11128	18. Dolomitic limestone: medium to dark brownish-gray, pelleted, miliolid, dolomitic biomicrite and muddy biosparite; I/IIIA; scattered light-tan and brown miliolid micrite clasts become fewer downward; dasyclad algal fragments more abundant downward. -- at 11121-28 - more dolomitic, laminated -- at 11127-28 - note scattered clasts with shell debris	16

KARNES COUNTY; STANDARD OF TEXAS, NO. 2 POLLOCK (36), PANNA MARIA FIELD

	EDWARDS GROUP PERSON FORMATION Cyclic Member--	
10802-10811	1. Limestone: dark-brown, burrowed, wispy, laminated micrite; IA; minor changes as noted: -- at 10802-04 - scattered miliolids -- at 10804-05 - channel deposit with thin hard crust at base -- at 10810.5 - dolomitic hard crust 1" thick	9

Depth (feet)		Thickness (feet)
10811-10820	2. Limestone: light- to medium-brown, Monopleura and caprinid biomicrosparite; IIIA, rusty, silty microspar matrix; shells abundant from 10814-20. -- at 10812 - coated clasts and rare corals (Cladophyllia) -- at 10814-20 - abundant whole fossils, matrix as above; rare large gastropods and dasyclad algae -- at 10819 - note evidence that rusty-silty microspar matrix is probably an early diagenetic feature: dense, pure miliolid micrite fills cavities in microspar matrix	9
10820-10838	3. Limestone: medium- to dark-brown, dense, gastropod biomicrite, and laminated micrite; IA/B. -- at 10820-27 - fine, laminated micrite with thin clast beds at 10821, 10826, 10827; sequence is completely dolomitized -- at 10827-31.5 - gap -- at 831.5-35 - abundant Orbitolina, gastropods, and oysters in muddy, wispy, burrowed matrix -- at 10835-38 - another zone of clasts, very coarse at bottom (fragments 1/4"-3"); are these reworked and mud-filled collapse breccias or channel-lag deposits?	18
10838-10843	4. Limestone: dark grayish-brown to medium-brown, burrowed, wispy in part, pelleted, oyster and gastropod biomicrosparite.	5
10843-10850	5. Limestone: medium-brown, pelleted, rudist biomicrite and muddy biosparite; IIIB, most pores are leached; note peculiar silty, rusty, intergranular microspar matrix; wispy structure common at 10844, 10847; whole-shells drop out at 10846, leaving microsparite with scattered skeletal debris; very dark in lower foot	7
10850-10856	6. Limestone: dark-brown, dense, Toucasia micrite and microsparite. -- at 10853 - half foot of gray dolomite at 10853 with leached shells -- at 10855-56 - homogeneous micrite in lower foot grades upward to peculiar rusty, silty intergranular microspar matrix	6
	Marine Member--	
10856-10871	7. Limestone: medium-brown, very coarse- to fine-grain, well-sorted, laminated, pelleted, mollusc-fragment biosparite; IIIA/B for the most part, some IIIC in coarse, shelly intervals; grains are well rounded, caprinid fragments; note apparent textural inversion--coarse skeletal sand mixed with fine, silt-size soft-pellets. -- at 10861-65 - pronounced varve-like wispy structures, with a suggestion of rippled surfaces; at 10862.5 note half foot of coarse skeletal lime-sand -- at 10865-71 - very coarse-grain biosparite, faint horizontal laminations	15
10871-10891	8. Limestone: medium-brown, wispy, fine-grain, pelleted, mollusc-fragment biosparite with scattered rudists; I/IIIA/B; fossils include Caprinuloidea, Monopleura, oysters, dasyclads, range up 3"; well-laminated where sediment is sand-size; fossils tend to occur in silty matrix; note punky material in pore spaces between grains--leached residue? -- at 10875-84, 10887-91 - concentrations of rudist shells	20
10891-10902	9. Gap	11
	Leached Member--	
10902-10908	10. Calcitic dolomite: medium-brown with dark grayish-brown mottles (burrows), dolomitized micrite; IIIA; abundant wispy structures, burrows, and stylolites	6
10908-10934	11. Dolomite: medium grayish-brown, homogeneous, fine-crystalline, dolomitized biomicrite and micrite; IIIA/B to IIIC; scattered intervals of leached skeletal debris as noted, also intervals of vague burrows; variations as follows: -- at 10909 - light brownish-gray, vaguely burrowed -- at 10911 - spar-filled fracture -- at 10914-15, 10920 - note light-brown, punky chert nodules (1") whose margins are being dolomitized; inside these chert nodules are bladed calcite crystals, suggesting the following sequence: (1) limestone with gypsum crystals, (2) gypsum dissolves, hole fills with spar, (3) replace limestone with chert, (4) dolomitize rock adjacent to chert nodules -- at 10923-25 - vague laminated structure with 1/4" carbonaceous shaly interval at top -- at 10925-34 - leached oyster shells produce excellent IIIB/C porosity with good oil-stain -- at 10926, 10930, 10933 - spar-filled cavities--old anhydrite nodules? -- at 10929 - large, light-brown chert nodule	26
	Collapsed Member--	
10934-10963	12. Dolomite: medium-gray, generally homogeneous, medium- to fine-crystalline, dolomitized burrowed micrite matrix, and well-defined collapse breccias at 10935, 10937, 10943, 10955, 10956, 10958.5; IIIB; open vugs with dog-tooth spar crystals at 10937, 10938, 10939; from 10942-45 zone of leached fossils. -- at 10952-53 - possible channel deposits with large clasts	29
10963-10972	13. Dolomitic limestone: dark brownish-gray, carbonaceous, dense, dolomitic, interbedded mollusc biomicrite and intramicrite; IA, some IIIA; variations as follows: -- at 10963-66 - burrowed and wispy, pelleted, oyster intramicrite; clasts are light-tan micrite -- at 10966-69 - finely-laminated (stromatolitic?) intramicrite; 1/2"-2" fragments of hard layers all mixed-up in very dark-brown micrite matrix; abundant wispy structures, root tubes, spar-filled mudcracks, abundant soft-pellets and a variety of clasts -- at 10969-71 - burrowed, pelleted, mollusc-fragment biomicrite; more burrowed downward -- at 10971-72 - large-clast intramicrite; clasts are dark-gray dolomite, probably hard layers, some broken, some flat, range up 3/4" thick, 3" long; distinct collapse breccia at 10971.5 replaced by chert; bottom half foot is wispy, dolomitic micrite	9
	Remarks: There is much less dolomite in the Person Formation of the Edwards Group here than in wells to the northeast in Person and Davy Fields.	

KARNES COUNTY; SHELL, NO. 1 ROBERTS (6); PERSON FIELD

	GEORGETOWN FORMATION	
10680-10686	1. Limestone: medium- to grayish-brown, dense, wispy, burrowed (in part), pyritic, clayey, very fine-grain, mollusc and foram micrite; IA; few pelagic forams visible, also common microspherulites, wispy areas rich in clay and/or carbonaceous matter; pyrite disseminated; note fine quartz and chert sand scattered through bottom foot; thin elongate burrows at 10683 look like root tubes; intact lower boundary not present in cores	6
	EDWARDS GROUP	
	PERSON FORMATION	
	Cyclic Member--	
10686-10690	2. Limestone: dark- to medium-brown, dense, miliolid and gastropod biomicrite; IIIA; note large bellerophontid snails at 10687-88; erratic mixtures of microspar and micrite, becomes burrowed with scattered chert sand at 10689	4
10690-10703	3. Limestone: dark brownish-gray, dense, extensively-burrowed, wispy, mollusc and miliolid intramicrite; IA; few oyster-like shell fragments at 10699; becomes dolomitic in lower 2 feet with light-gray dolomitic hard crust at base; clasts are of several kinds: brown miliolid microsparite, light-gray micrite, etc.; they range in size from medium sand to pebbles; skeletal fragments mostly mollusc; few miliolids; note steeply inclined (45°) bedding at 10699. -- at 10691.5-97 - gap	13
10703-10710	4. Dolomitic limestone: medium-brown and gray, burrowed, dolomitic mollusc and coral biomicrite; IIIA mostly; extensive burrowed areas filled with coarsely granular pelletal microsparite; allochems are gastropods, corals (Cladophyllia), rudists (several varieties), also some mud clasts; rock at 10706-10 appears to have had fossils leached, then mud-filled; fragmented dolomite hard crust at 10709-10	7
10710-10716	5. Limestone: medium to dark grayish-brown, carbonaceous, wispy, burrowed, mollusc-fragment biomicrosparite; IA; matrix mostly microspar with some non-burrowed areas filled with micrite; sequence begins with apparent mudcracked hard crusts; molluscs are like small fragile oysters	6
10716-10719	6. Limestone: essentially as above, with thin, light-brown, dolomitic hard layer at base	3
10719-10723	7. Calcitic dolomite: medium-brown to light grayish-brown, poorly-sorted, very coarse, angular clast intramicrite and collapse breccia; IIIA/B; finely laminated in top foot, then burrowed, grading down to coarse collapse breccia or unsorted channel lag; see apparent channel edge in slab at 10721.5; grades down to 6" of fine-pellet microsparite at 10722, then back to coarse channel(?) lag; finely dolomitic and completely replaced by white and gray chert in bottom foot	4
10723-10728	8. Limestone: medium-brown, wispy, dense, homogeneous, silt-size and fine-grain, soft-pellet intramicrosparite; I/IIIA	5
10728-10737.5	9. Dolomite: medium brownish-gray, very coarse, fine-crystalline, dolomitized, angular clast intramicrite and burrowed, dolomitized micrite; IIIB; sequence as follows: -- at 10728-32 - dolomitic micrite, burrowed extensively, with scattered leached shell fragments (one high-spired snail at 10730.8) -- at 10732-32.5 - very coarse and angular clast intramicrite; hard to tell whether it is a mud-filled collapse breccia or a channel-lag deposit; a few pores filled by calcite -- at 732.5-34 - as 10728-32, but with vertical cracks (calcite-filled) -- at 10734-37.5 - very coarse (medium-grain to small boulders) angular-clast, dolomitized intramicrite; clasts vary in composition, but some are clearly broken stromatolitic hard layers	9.5

Depth (feet)		Thickness (feet)
10737.5-10746	10. Dolomite: medium-brown, burrowed, dolomitized, mollusc biomicrite; IIIB; shells are fragile molluscs that have been leached; note also fine vertical cracks filled by sparry calcite; other changes as follows: -- at 10737.5-38.5 - dark-to medium-gray dolomite with large, long, spar-filled vertical fractures, highly leached; grades downward to lithology as above -- at 10745-46 - black chert nodule	8.5
10746-10761	11. Gap	15
	Marine Member--	
10761-10795	12. Limestone: medium-brown, fine- to medium-grain, soft-pellet intramicrite and mollusc biomicrite and biosparite; I/IIIA; pellets and matrix replaced by microspar; shells in part calcite, in part leached and filled with microspar; shells occur whole or as large fragments, include caprinids, Toucasia, Foraminiferites; minor changes follow: -- at 10761-65 - large whole Toucasia -- at 10765-75 - become finer-grain, burrowed, wispy, shells much less abundant -- at 10775-86 - gap -- at 10786-95 - shells reappear, mostly caprinids, Foraminiferites, common small flat oysters, one Cladophyllia -- at 10788 - brown chert nodule 6" in diameter	34
10795-10812	13. Limestone: medium-brown, wispy, burrowed, pelleted, mollusc-fragment biomicrosparite; I/IIIA; matrix entirely microspar; other features: -- at 10796-97 - two large burrows or round clasts of light-brown micrite in microsparite matrix -- at 10802-05 - gap -- at 10805-12 - burrowing becomes more severe; gradational lower boundary	17
	Leached Member--	
10812-10821	14. Calcitic dolomite: medium brownish-gray, wispy, burrowed, dolomitized microsparite; IIIA/B; becomes progressively more dolomitic, more porous downward; rock texture essentially continues from unit above, but rock becomes dolomitized. -- at 10820-21 - note coarsely shelly, burrowed, granular bed	9
10821-10846	15. Dolomite: light to medium brownish-gray, burrowed, dolomitized micrite; IIIB; rock so thoroughly dolomitized that most original structure and texture is gone; note common large (1/2"-2") rounded calcite bodies--they appear to be casts of dissolved gypsum nodules filled-in with sparry calcite? They occur at : 10821-23, 10824-25, 10828-29, 10833-34, 10835-36, 10837. -- at 10837-40 - collapse breccia with large spar-filled vertical fractures -- at 10840-46 - massive dolomite with small angular lath-like spar-fillings scattered throughout--former gypsum or anhydrite crystals?	25
	Collapsed Member--	
10846-10847.5	16. Dolomite: dark brownish-gray, granular, burrowed, dolomitized, oyster biomicrite; IIIB; high proportion of carbonaceous material; oysters small, fragile, leached, replaced by sparry calcite	1.5
10847.5-10850	17. Dolomite: medium-gray, burrowed, dolomitized, oyster micrite; IIIB; essentially similar to 10840-46; note lath-like areas as above	2.5
10850-10869	18. Dolomite: medium-gray to dark grayish-brown, burrowed (in part), dolomitized angular clast intramicrite and mollusc biomicrite; IIIB/C; variable sequence as follows: -- at 10850-51 - burrowed dolomitized micrite with scattered flat molluscs -- at 10851-52 - coarse collapse breccia -- at 10852-55 - as 10850-51 -- at 10855-56 - very dark-gray, carbonaceous, wispy, intramicrite--channel deposit(?) -- at 10857-58 - light-gray, burrowed, leached, and fractured dolomite--exposure zone(?) -- at 10858-59 - very dark grayish-brown, carbonaceous, wispy, burrowed, oyster biomicrite -- at 10859-61.5 - light-gray, leached, fractured, dolomitized, mollusc-shell intramicrite; interval 10860-61 apparently a hard layer with exposure surface at top; large calcite vein at 10860 -- at 10861.5-63.5 - abrupt change to brownish-gray, burrowed, intramicrite, only slightly dolomitic -- at 10863.5-65 - essentially as above, but with soft-mud pellets rather than clasts -- at 10865-69 - burrowed dolomite clast rock similar to 10855-56	19
10869-10885	19. Gap	16
10885-10895	20. Limestone and dolomite: dark grayish-brown, burrowed, mollusc biomicrite; IA (limestone) and IIIA/B (dolomite); molluscs are fragile, whole oysters(?); minor changes as noted: -- at 10885-88 - brownish-gray dolomite -- at 10888-93 - limestone as described -- at 10893-95 - changes to featureless, medium-gray, homogeneous dolomitized micrite	10
	Regional Dense Member--	
10895-10912	21. Limestone: very dark grayish-brown, burrowed, wispy, pyritic, mollusc micrite and intramicrite; IA; no microspar; composite, partly-coated clasts from Kainer Member become more abundant downward. -- at 10895-904 - snail casts common -- 10904 - first Kainer Member clasts--rare -- 10905-12 - becomes very wispy -- at 10909 - Kainer composite clasts common -- at 10910 - large Kainer-type composite clasts	17
10912-10915	22. Limestone: dark grayish-brown, Toucasia intramicrite; IA; shells occur whole or as large fragments; clasts are micrite and miliolid micrite; matrix is micrite with miliolids scattered through; becomes very wispy and coarsely clastic in bottom foot	3
	KAINER FORMATION	
	Grainstone Member--	
10915-10986.5	23. Limestone: medium- to dark-brown, current-laminated, well-sorted, fine- to coarse-grain, clast and miliolid biosparite; IA mostly; note thin intervals of coarse mollusc-fragment sands at 10916, 10919, 10923, 10925, 10933, 10936, 10937, 10938, 10939, 10941, 10964, 10972-74, 10980, 10984; even, flat current bedding common throughout; some pellets and miliolids replaced by microspar which is apparently highly susceptible to leaching, producing porosity but usually little permeability; at 10972-76 note large caprinids, corals, stromatoporoids and coated grains in miliolid micrite matrix	71.5
	Remarks: a. Between 10705-40 note seven successive cycles of shallow marine, intertidal and supratidal rocks. b. Good collapse breccias and calcite-replaced anhydrite features in leached and collapsed beds of Person Formation. c. Person-Kainer boundary not discrete and sharp in this core.	

KARNES COUNTY; SEABOARD, NO. 1 SZALWINSKI (38); FALLS CITY (WILCOX) FIELD

	GEORGETOWN FORMATION	
10475-10476	1. Limestone: light- to medium-gray, dense, argillaceous, pyritic, wispy micrite with scattered small mollusc fragments; IA	1
10485-10486	2. Limestone: medium brownish-gray, fine-grain, mollusc biomicrite with scattered clasts and calcispheres; IA; in middle of slab note finely-laminated streak; above are scattered moderately rounded, light-gray micrite clasts; one stromatoporoid, one possible Globigerina	1
10496	3. Limestone: medium brownish-gray, dense, mollusc biomicrite as above, no clasts, somewhat wispy.	
10515	4. Limestone: medium grayish-brown, burrowed, very fine-grain, mollusc biomicrite, wispy structures gone; no definite pelagic forams.	
10520	5. Limestone: basically as above; not so much burrowing.	
10535	6. Limestone: as above, more wispy structures, becoming medium-gray.	
10545	7. Limestone: as above, very dense, medium- to dark-gray.	
10554	8. Limestone: medium- to dark-gray, wispy, argillaceous, fine-grain, mollusc biomicrite; IA.	
10555	9. Limestone: as above, non-wispy, with Globigerina	
	EDWARDS GROUP	
	PERSON FORMATION	
	Cyclic Member--	
10562	10. Limestone: angular conglomerate with four different kinds of clasts: (a) weathered pebbles of light-gray Globigerina-calcisphere biomicrite = GEORGETOWN, (b) medium grayish-brown, pelleted mollusc and Globigerina biomicrite = GEORGETOWN, (c) dark-brown, mollusc and miliolid intramicrite = EDWARDS, (d) light-brown, miliolid biomicrite = EDWARDS. Compare with "cave" in top 4' of Shell, Urbanczyk No. 2.	

Depth (feet)		Thickness (feet)
10566	11. Limestone: medium-brown, dense, muddy miliolid biosparite; IA.	
10571	12. Limestone: medium-brown, poorly-sorted, Toucasia and miliolid biosparite; IA; no microspar. Note distinct pelleted areas; also areas around outside of shells have halos of very light-brown, granular, soft calcareous material--rotten microspar(?); looks like maybe shell was partly dissolved, and granular material filled up the hole.	
10575	13. Limestone: medium-brown, Toucasia biomicrite; IA; mostly with few scattered vugs; shells occur whole and fragmented; some were dissolved, filled with sparry calcite.	
10577	14. Limestone: medium-brown, pelleted, Toucasia biomicrite; IA; similar to above but fewer broken shells.	
10585	15. Limestone: medium-brown, dense micrite; IA; scattered small pellets, mollusc debris.	
	EDWARDS GROUP	
	PERSON FORMATION (UNDIVIDED)	
10589-10698	16a. Limestone: dark-brown, clast and pellet intramicrite; clasts occur as soft-sediment slumps of light- to medium-brown miliolid-pellet micrite in denser, dark brownish-gray micrite.	
10589-10698	b. Dolomitic limestone: "mid-Edwards"(?); dense, note one spar-filled vertical fracture; dolomite clasts scattered throughout burrowed micrite matrix.	
10589-10698	c. Dolomitic limestone: "mid-Edwards"(?); light- to medium-brown, slightly wispy, dolomitic micrite with scattered oysters, pellets, a little vague evidence of burrowing; IA/IIIA.	
10589-10698	d. Dolomite: "lower-Edwards"(?); medium-brown, intensely burrowed, dolomitized micrite; fair porosity IIIA/B.	
10589-10698	e. Dolomitic limestone: "lower-Edwards"(?); medium- to dark-brown, churned, wispy, slightly dolomitic micrite; IA; looks like Regional Dense Bed lithology.	
	Remarks: (a) Cores consist of scattered slabbed pieces of core, described above. (b) Distinct cave-filling in Edwards just below Edwards-Georgetown contact.	

KARNES COUNTY; SHELL, NO. 2 L. URBANCZYK ET AL (30); PERSON FIELD

	GEORGETOWN FORMATION	
10722-10734	1. Argillaceous limestone: medium brownish-gray, argillaceous, burrowed, wispy, pyritic, very fine-grain, mollusc and foram biomicrite; I/A; skeletal debris includes common calcispheres, Globigerina, small fragile mollusc-fragments. -- at 10731-32 - severe burrowing and rounded, weathered, non-argillaceous clasts of light-gray Globigerina biomicrite in wispy matrix -- at 10733.5 - large, burrowed, non-argillaceous Globigerina biomicrite clasts with weathered rim; matrix grades to fine-grain pelleted mollusc and foram biomicrite; note probable sponge	12
10734-10735.5	2. Limestone: light brownish-gray, dense, pyritic, very fine-grain, Globigerina calcisphere biomicrite; IA; this is the rock from which clasts in unit above were derived. -- at 10735.5 - Georgetown-Edwards contact is exceptionally abrupt with a thin layer of pyrite (1/32") separating the lithologies; wispy streak 1" thick begins 1" above the contact	1.5
	EDWARDS GROUP	
	PERSON FORMATION	
	Cyclic Member--	
10735.5-10741	3. Limestone: medium-brown, poorly-sorted, skeletal intramicrosparite; IA; skeletal fragments include rare miliolids, large radiolite fragments, whole caprinids, probable green algae, unidentified skeletal debris; intraclasts are round pebbles; rock thoroughly mixed-up and churned. -- at 10738 - note what appears to be a cave(?) or burrow in the Edwards filled with Georgetown matrix (Globigerina, etc.) in which are Edwards clasts -- at 10739-41 - larger shell debris drops out leaving well-sorted, pellet intramicrosparite	5.5
10741-10761	4. Gap	20
10761-10768	5. Limestone and dolomite: dark-brown and light-gray, evenly-laminated, fine-grain, pelleted micrite; IA and IIIA/B (dolomite); note even laminations, also carbonaceous streaks; not stromatolitic--more like settle-out laminae; 1-foot dolomitic streaks at 10761, 10763.5, 10766; sequence terminates in peaty 6" detrital clast unit (channel deposit) overlain by 6" slumped interval; note rounded detrital chert grains and organic peat fragments in base of unit. -- at 10766-68 - gap	7
10768-10774.5	6. Limestone: very dark-brown, poorly-sorted, foram intramicrite; IA; clasts predominate from 10768-71 with spar-filled desiccation cracks; below 10771, burrowed skeletal biomicrite becomes dominant (whole Orbitolinas). -- at 10773.5 - small oyster shells -- at 10774.5 - abrupt boundary, with moderately-sorted intramicrite overlying dolomite hard crust (base of another cycle?) that in turn overlies thoroughly-burrowed dolomitized micrite	6.5
10774.5-10781	7. Limestone: medium- to dark-brown, pelleted and oyster biomicrosparite; IA; few snail steinkerns; burrowed throughout with dolomite concentrated in burrows; upper foot dolomitic. -- at 10780 - hard crust, non-dolomitic -- at 10780.5 - begins to grade into unit below	6.5
10781-10783.5	8. Limestone: medium-brown, medium-grain, well-sorted, pelleted gastropod biosparite; I/IIIA/B; partly replaced by microspar. -- at 10782 - large Chondrodonta-like oysters with white chert rosettes in 6" streak -- at 10783 - large clast composed of current-laminated micrite	2.5
	Marine Member--	
10783.5-10818	9. Limestone: light to medium grayish-brown, medium- to coarse-grain; well-sorted, pelleted, mollusc biosparite and biomicrite, IIIA/B; large oysters and Toucasia; many large shells replaced by white chert; micrite generally replaced by microspar, except at 10789-90.5. -- at 10791 - few Cladophyllia-type corals, common whole radiolites, more micrite -- at 10793-96 - gap -- at 10796.5 - common corals, with small Toucasia, whole shells drop out -- at 10798 - first distinct current streaks -- at 10804.5 - coarse mollusc-fragment biosparite; no large shells -- at 10804 - gray chert nodule, 3" in diameter -- at 10804-06.5 - matrix of above becomes finer-grain, still microspar; abundant large fragments of Toucasia, radiolites, Cladophyllia, etc. -- at 10806.5-13 - back to current-sorted, medium- to coarse-grain, mollusc biosparite; pores are leached microspar that replaced shells, then was dissolved; some occur as small vugs -- at 10813-18 - becomes abruptly very fine-grain, pelleted, muddy mollusc biosparite with thin streaks of coarse mollusc-fragment biosparite	34.5
10818-10821.5	10. Limestone: medium-brown, medium- to coarse-grain, well-sorted, skeletal biosparite; IIIB; current streaks, finer-grain downward, common scattered white chert rosettes	3.5
10821.5-10842.5	11. Limestone: medium brownish-gray, poorly-sorted, very coarse-grain to pebbly, caprinid biosparite; IIIB/C; chert replaces shells, in places composes up to 90 percent of rock, as at 10838-42.5. -- at 10822-32 - gap -- at 10832 - chert so abundant it acts as cement--white-banded, onyx-like; many large open vugs; common gilsonite at 10835-38 -- at 10842 - extremely coarse shell debris, sharp lower boundary (shells simply stop abruptly)	21
10842.5-10845	12. Limestone: dark grayish-brown, medium-grain, well-sorted, cross-bedded, pelleted, mollusc-fragment biosparite; IIIB; porosity results from leaching of grains leaving only sparry cement; becomes finer-grain downward; distinct cross-bedding; this unit may represent basal part of marine cycle	2.5
10845-10852	13. Dolomitic limestone: very dark-gray, dense, burrowed, carbonaceous dolomitic micrite; I/IIIA; limestone component is extremely fine microspar; dolomite crystals scattered, very fine; 2 small gray chert nodules at 10848.5	7
	Leached Member--	
10852-10876	14. Dolomite: medium-gray to grayish-brown, homogeneous, thoroughly-burrowed, fine-crystalline, dolomitized micrite; IIIB; generally featureless, note minor features below: -- at 10852-56 - very thin, hairline fractures--incipient collapsing(?) -- at 10856 - few larger spar-filled fractures -- at 10859 - two-inch calcite-filled area--suggests dissolved and replaced anhydrite nodule; note 2" spar-filled cracks extending 6" beneath -- at 10860-62 - streak of brown dolomite -- at 10862-70 - gap -- at 10870-71 - distinct spar-filled cracks, narrow and not developed to point of collapse -- at 10872.5 - two-inch calcite-lined vug--dissolved anhydrite nodule(?); also note one brown chert nodule 2" across -- at 10874-76 - three scattered small round patches of calcite--almost surely calcite-replaced anhydrite nodules	24

Depth (feet)		Thickness (feet)
	Collapsed Member--	
10876-10895	15. Dolomite: medium to dark grayish-brown, dolomitized, mollusc-fragment micrite and biomicrite, burrowed in part, with collapse structures; IIIB; other features: -- at 10876 - first bonafide collapse structure--small, does not extend across core face -- at 10877-84 - intensely burrowed, with scattered small shell fragments -- at 10887 - becomes less dolomitic, dark-brown, dolomitic mollusc biomicrite; few dolomite clasts, wispy structures -- at 10889-90 - one-foot dolomite interval with thin stromatolitic crust overlying thin distinct collapse zone with calcite-replaced anhydrite nodules -- at 10890 - churned with common shell fragments -- at 10891-93 - abrupt change to light brownish-gray, dolomitized, small clam and snail biomicrite; IIIB; pure dolomite; nodules of sparry calcite; distinct collapse at 10892, in-filled with calcite and gilsonite -- at 10893-95 - change to dark-brown, burrowed, wispy, dolomitic micrite.....	19
10895-10902	16. Dolomite and dolomitic limestone: medium-gray and dark-brown, poorly-sorted intramicrite; IIIA/B; two distinct, thin, broken hard crusts at 10897-98; angular large dolomite clasts in micrite in basal 2 feet. -- at 10895 - spar-filled nodules, some collapsed	7
10902-10916	17. Dolomite: medium grayish-brown, homogeneous, churned in part, laminated in part, dolomitized micrite; IIIB, entire unit shows evidence of incipient collapse-cracking with large spar-filled cracks in upper foot. -- at 10907-08 - current laminations -- at 10908 - small collapse -- at 10913 - small collapse overlying 1-foot sequence of undulose and disrupted laminae, some of which probably represent dissolved anhydrite streaks, some may be stromatolitic; intensely burrowed from 10913-16.....	14
	Regional Dense Member--	
10916-10923	18. Limestone: dark-brown, laminated, wispy, micrite. -- at 10916-18 - possible very thin crust above whole-oyster biomicrite -- at 10918-20 - becomes slightly dolomitic, medium-brown -- at 10920-23 - becomes dark-brown, non-dolomitic, very wispy, dense micrite with scattered fragile clams and gastropods	7

KARNES COUNTY; CHRISTIE, ET AL, NO. 3 WEDDINGTON (54); FASHING FIELD

EDWARDS GROUP
PERSON FORMATION
Cyclic Member--

10801-10802	1. Dolomitic limestone: dark-brown, disrupted dolomitic micrite with large (3") rounded clasts of medium-brown miliolid biomicrite; also streaks of very argillaceous micrite; this is rubble zone at top Edwards.....	1
10802-10884	2. Limestone: medium-brown, poorly-sorted, burrowed, pelleted, Toucasia-fragment biomicrosparite; IIIA; thoroughly altered to microspar; Toucasia occurs as large fragments and small broken chips. -- at 10805-09 - wispy laminations and streaks, some inclined bedding -- at 10809-12 - finer-grain, large shells gone -- at 10812-13 - large whole Toucasia in pellet matrix--severely altered -- at 10815-16 - severely burrowed with 2" layer of flat clasts -- at 10817 - large shells gone, as at 10809-12, mostly fragile shell debris in fine microspar matrix -- at 10822-25 - as above, but with common miliolids -- at 10825 - distinct, thin limestone stromatolite with worm tubes or elongate curved pellets -- at 10825-26 - as 10822-25, but with large clasts or internal fossil molds of darker-brown, less altered material -- at 10826-29 - as 10812-13 -- at 10829-30 dark-brown, wispy, laminated, with thin hard crust at base -- at 10830 - dark- to medium-brown, pelleted, miliolid microsparite -- at 10833-35 - as above, with laminations like 10805-09 -- at 10835 - thin, dark-brown streak of pelleted, mollusc-fragment muddy biosparite -- at 10836 - scattered large Toucasia fragments; stromatoporoid mass at 10839 -- at 10840-50 - most large shells gone except for shelly streak at 10841-43; scattered miliolids -- at 10850 - becomes dark-brown -- at 10854-55 - wispy interval -- at 10855 - spar-filled crack 1"x2" -- at 10859 - burrowed; burrow fillings are unaltered muddy intrasparite; intraclasts are pellets -- at 10860-64 - as above with scattered Toucasia, other mollusc-fragments -- at 10865 - scattered dolomite in burrow -- at 10866-68 - coarse-grain, porous, mollusc biosparite; porosity results from leached fillings of shells, dense part of rock is spar cement -- at 10868-71 - fine-grain, pelleted, mollusc-fragment biomicrosparite; no large shells -- 10871-72 - becomes dark-brown, dense, very fine-grain, mollusc-fragment biosparite -- at 10872 - dark-brown, thoroughly dolomitized, mollusc biomicrite -- at 10873 - very dark gray, dense, wispy, fine-grain, mollusc-fragment biomicrite -- at 10876-84 - common Orbitolina.....	82
10884-10890	3. Dolomitic limestone: very dark-gray, burrowed micrite; IIIA/B; some thin streaks of dense micrite, black chert nodule at 10884.....	6
10890-10936	4. Limestone: medium-brown, pelleted, mollusc-fragment, muddy biosparite and biomicrosparite as 10874; minor changes as noted. -- at 10891 - stromatoporoid masses--unaltered to microspar -- at 10897 - grayish-brown chert knots -- at 10903-04 - severely-burrowed, mollusc-fragment biomicrite completely replaced by knot of gray chert 6" thick -- at 10906-09 - current-laminated, fine-grain, pelleted, mollusc-fragment biosparite with grains replaced by microspar -- at 10915-16 - thin hard crust; burrowed beneath, with clasts -- at 10917-20 - medium- to dark-gray featureless (burrowed?) leached-skeletal dolomitized micrite -- at 10920-28 - very fine-grain, microsparite with few shells -- at 10928-30 - very dark-gray, pelleted, mollusc-fragment biosparite, entirely chert-replaced -- at 10930-33 - medium- to dark-brown microsparite with two irregular 3" chert masses at 10931-32 --Boxes 15 and 16 are unnumbered, but apparently represent the interval 10933-36; they contain biomicrosparite as above, with very scattered dolomite mixed with microspar in Box 15, and incipient collapse features with chertified cobbles in Box 16.....	36
	Remarks: No definite boundary between Cyclic and Marine Members in this core.	

KARNES COUNTY; STANDARD OF TEXAS, NO. 1 WIATREK (10); PERSON FIELD

GEORGETOWN FORMATION

10751-10775	1. Limestone: medium grayish-brown, pyritic, wispy, Globigerina micrite; IA; abundant pelagic forams, calcispheres; disseminated pyrite throughout; wispy areas more argillaceous; burrowing in a few areas.....	24

EDWARDS GROUP
PERSON FORMATION
Cyclic Member--

10775-10778	2. Limestone: light grayish-brown, limestone-pebble soil zone. Porosity irregular, vugular; fragments are angular, leached cobbles of light-gray micrite, mollusc-fragment biomicrite and microsparite; very soft, punky, medium- to fine-crystalline, microspar "soil" fills irregular spaces between cobbles; fossils in cobbles are Chondrodonta, coral, miliolids (rare), caprinids. -- at 10775 - three-inch thick limestone with micrite matrix containing fine skeletal debris, miliolids, stromatoporoids; at top, sharp boundary with definite Georgetown, at base, abrupt change into soil zone.....	3
10778-10809	3. Limestone: medium-brown to dark grayish-brown, burrowed, wispy (in part) pelleted, mollusc biomicrosparite and microsparite; IIIA; matrix entirely microspar -- at 10778 - five closely-spaced stylolites -- at 10793-95 - common large Foraminites, Toucasia, few Chondrodonta and gastropods in microspar matrix -- at 10795-98 - wispy, soft-pellet, coarse-grain, muddy intrasparite--appears as micrite now, because pellets have been mashed together -- at 10807-08.5 - grades to medium brownish-gray, burrowed, dolomitic micrite -- at 10808.5-09 - medium grayish-brown, dolomitic, pebbly lithoclast intramicrite with interspersed wavy laminae--probable basal clastic layer of channel sequence, reworked, mud-filled collapse.....	31

Depth (feet)		Thickness (feet)
10809-10820	4. Limestone: medium-brown, burrowed, mollusc biomicrosparite; I/IIIA; molluscs include Chondrodonta, oysters, Caprinuloidea, rare Toucasia; shells fractured into large fragments; some white chert replaces oyster shells; rock becomes dark grayish-brown in lower foot, highly burrowed	11
10820-10830	5. Calcitic dolomite: medium-brown, finely- and evenly-laminated, dolomitic micrite; IIIA/B; distinctive laminated structures similar to Pollock structures; entire interval forms one cycle as follows: -- at 10820-25 - very even laminations -- at 10825-26.5 - laminae become somewhat scalloped -- at 10826.5-28 - begin to pick up rare small shell fragments, rock is generally laminated, but also vaguely burrowed -- at 10828-29.5 - shells increase, also burrowing, rock becomes dark grayish-brown -- at 10829.5-30 - medium-gray, pebbly, dolomite-clast intramicrite with distinct 2" hard layer at base	10
10830-10844	6. Dolomite and limestone: light grayish-brown, burrowed, dolomitic (in part), oyster micrite and biomicrite; IA (limestone) IIIA/B (dolomite); interval variable, changes as noted: -- at 10830-32 - light grayish-brown, burrowed, grades downward to very dark-gray, burrowed limestone with common small oysters -- at 10832-38 - grades abruptly back to light grayish-brown, burrowed, calcitic dolomite with scattered small shells -- at 10838-38.5 - thin chert-replaced hard crust, with shell concentration below -- at 10838.5-39 - burrowed as above -- at 10839-40.5 - dark-gray, burrowed, wispy, micrite with oysters, grading down to thin, finely-laminated dolomite grading to 2" crinkly, dolomitized hard crust -- at 10840.5-42 - grades to dark-gray, burrowed oyster micrite -- at 10842-43 - medium-brown, pelleted, gastropod biomicrite -- at 10843-44 - grades back to dark-gray, burrowed, oyster micrite	14
10844-10854	7. Dolomitic limestone: medium brownish-gray, burrowed, partly dolomitic micrite; IIIA/B; dolomitic in upper foot and from 10849-52, with excellent porosity (IIIB); scattered small shell fragments; 6" interval of finely-laminated micrite at bottom -- at 10853 - thin black chert nodule	10
	Marine Member--	
10854-10895	8. Limestone: medium-brown, wispy, whole-mollusc biomicrosparite; IIIA/B; fossils include Coradiolites, Chondrodonta, Toucasia, caprinids, Cladophyllia-type corals; throughout interval many shells are partly replaced by white chert rosettes; microspar matrix throughout except for upper foot; stylolites are common in vicinity of wispy structures; other changes as noted: -- at 10854 - Chondrodonta common, also wispy structures -- at 10854-55 - thin interval of gray chert replaces mollusc biosparite -- at 10857-65 - shells abundant, large caprinids at 10861-65 -- at 10865-70 - very few large shells, scattered Cladophyllia-type corals -- at 10870-73 - microsparite with scattered Toucasia -- at 10873-74 - black chert nodule -- at 10874-76 - gap -- at 10876-78 - microsparite with scattered Toucasia -- at 10878-82 - gap -- at 10882-85 - microsparite, few small, very scattered shells, commonly chert-replaced -- at 10885-95 - Coradiolites and caprinid biomicrosparite, shells commonly chert-replaced -- at 10890-92 - gap	41
	Leached Member--	
10895-10937	9. Dolomite: medium-gray, homogeneous, faintly-burrowed, fine-crystalline, dolomitized micrite; IIIB; virtually featureless; faintly wispy in upper 8 feet. -- at 10899-901 - collapse breccia with excellent porosity (IIIC); some pores look like leached shell debris -- at 10901 - two small (1") round areas of brown, soft, punky, earth matter filling vugs with white, bladed anhydrite crystals in center of vugs -- at 10912, 10914, 10923, 10925, 10926 - patches of white crystalline calcite 1/2"-2" across--calcite filled anhydrite nodules -- at 10895-923 - dark grayish-brown; changes to medium brownish-gray from 10923-37; the color change may be due only to oil saturation	42
10937-10946	10. Dolomitic limestone: medium grayish-brown, burrowed, dolomitic oyster and rudistid biomicrite; I/IIIA; white rosette-type chert replaces oyster shells; note fine-chambered rudist shells. -- at 10940-44 - light grayish-brown dolomite -- at 10944-46 - very dark brownish-gray	9
	Collapsed Member--	
10946-10966	11. Dolomite: medium to dark grayish-brown, very poorly-sorted, very coarse-grain (1/4"-3"), angular, dolomite-clast intramicrite and intrasparite; IIIB; clasts are finely-laminated dolomite and brown micrite, oriented very erratically; some appear to have been slumped and broken while soft. -- at 10946-48 - good leached porosity (IIIC) in collapse breccia -- at 10949-55 - grades to dolomitic limestone, structure as above -- at 10955-58 - pelleted dolomitized intramicrite -- at 10958-64 - very dark grayish-brown, finely-laminated, leached dolomitized micrite; some leached porosity associated with shell debris; one large vug at 10963.5; upper boundary undulatory, abrupt; IIIB/C -- at 10964-66 - dolomitized, severely leached intramicrite; good porosity, IIIC	20
10966-10988	12. Dolomite: medium to dark grayish-brown, homogeneous, fine- to medium-crystalline, burrowed (in part), laminated (in part), dolomitized micrite; IIIB; note minor variations: -- at 10966-68 - extensive burrowing -- at 10969 - note fine vertical pores--root-holes(?) -- at 10970-74 - long calcite-filled vertical fracture 1/4" wide -- at 10976.5 - intensely burrowed -- at 10980-82 - thin interval of medium brownish-gray, dense, oyster micrite -- at 10982-84.5 - wispy and burrowed, dolomitic micrite; note burrows at 10983.5 with dolomite halos around them; see similar structures in Shell, Kruciak No. 1-A -- at 10984.5-88 - medium brownish-gray, dense, dolomitized micrite	22
	Regional Dense Member--	
10988-11002	13. Dolomitic limestone: very dark-brown, dense, slightly argillaceous, slightly dolomitic, burrowed, wispy, mollusc micrite and intramicrite; clasts are mostly small, consist of miliolid biomicrite; larger (1/8"-1/4"), more abundant from 10993 down; finely disseminated pyrite throughout; fresh rock surface has waxy, shaly aspect; molluscs are small fragile clams; bottom of core probably five to ten feet above top of Kainer Formation. -- at 10993-95 - pelleted gastropod and green algae biomicrite, gradational above and below; storm layer(?) -- at 10993 - white chert replaces oyster shell -- at 10995 - white calcite fills vertical vein Remarks: (a) Note distinct 3-foot soil zone developed at top of Edwards. (b) Distinct series of tidal-flat cycles similar to those in Shell, Roberts in Cyclic Member. (c) Excellent core, almost no gaps and completely slabbed.	14

KARNES COUNTY; TENNECO, NO. 1 WIATREK (12); DAVY FIELD

	GEORGETOWN FORMATION	
10980-10990	1. Limestone: dark to medium grayish-brown, dense, slightly argillaceous micrite; IA; contains thin carbonaceous streaks and films, rare blebs of pyrite, some interstitial pyrite; pure micrite occurs as fish-size rounded masses--burrows(?); note some streaks of mud with calcispheres and Globigerina. -- at 10990 - Georgetown-Edwards boundary is simple, abrupt, undulatory, limestone-on-limestone contact--no iron stain, glauconite, truncated structures, etc. are visible	
	EDWARDS GROUP	
	PERSON FORMATION	
	Cyclic Member--	
10990-11012	2. Limestone: light-brown, dense, microsparite alternating with very light grayish-brown, medium-grain, muddy, mollusc-fragment and miliolid biosparite; IA and IIIA; muddy beds 4-6" thick, shelly beds about 2" thick; skeletal debris consists of miliolids, clam-shell fragments, rudist fragments, in upper 1', miliolids appear lined or filled with asphalt; matrix probably has high organic content; note persistent oil stain--medium brownish throughout core.	

Depth (feet)		Thickness (feet)
	-- at 10993 - one-foot interval with large fragments of Toucasia and caprinids -- at 10994-11001, 11006-11002 - shells generally less abundant -- at 11006 - skeletal grains with light cream coatings	22
11012-11022	3. Limestone: medium-brown, moderately-sorted, fine- to coarse-grain, mollusc-fragment biomicrite and biomicrosparite; IIIA/B, streaks of different-size grains with some of the silt-size, rusty microspar matrix of above; no dolomite observed, some grains coated. -- at 11017-19 - porosity exceptional but holes probably unconnected -- at 11021 rare scattered patches of dolomite	10
11022-11040	4. Dolomitic limestone: light- to medium-brown, fairly homogeneous, fine-crystalline, dolomitized microsparite similar to matrix of 10993-12; finely porous; IIIB. -- at 11022-23 - wavy, dendritic, carbonaceous, wispy streaks that coalesce and merge -- at 11023-24.5 - dark-brown, burrowed -- at 11024.5-27.6 intraformational conglomerate with flat dolomitic pebbles and shell fragments--channel lag(?) -- at 11027.6-30 - distinct dolomitic hard crusts a la Andros Island -- at 11030-40 - thoroughly churned and burrowed -- at 11033 - spar-filled "fractures", each of which is surrounded by black pyrobitumen halo -- at 11037 - root casts(?)	18
11040-11051.5	5. Dolomitic limestone: medium- to dark-brown, fine-crystalline, dolomitized microsparite; I/IIIA/B; burrowed in part; dolomite decreases below 11045. -- at 11044 - intraformational soft-clast conglomerate, also thin, indistinct, very dark layers that produce a light-brown and black effect--light brown rock with miliolids -- at 11048 - one distinct dolomitized hard crust -- at 11049 - fist-size, rounded, black chert nodule containing mollusc-shell debris	11.5
	Marine Member--	
11051.5-11056.5	6. Dolomitic limestone: dark-brown, dense, slightly burrowed, slightly dolomitic micrite; IA. -- at 11054 - large (2"x4") muddy biosparite clast -- at 11055-5615 - thin streaks of mollusc-shell debris	5
11056.5-11090	7. Limestone: medium-brown, dense, burrowed, mollusc-fragment biomicrosparite and microsparite; IA; some intervals contain large whole mollusc shells; other features: -- at 11064-69 - abundant large shells (Toucasia, oysters, Chondrodonta) in burrowed micrite; also sparry areas with clasts -- at 11069-72 - microsparite matrix continues, shell debris absent; note black carbonaceous laminae, non-burrowed -- at 11072-77 - shelly micrite resumes slight chalky aspect -- at 11083 - miliolids appear -- at 11084, 11087 - large gray chert nodules (1.5'thick); apparently silicified, burrowed limestone -- at 11086-90 - Toucasia shells common, matrix of above continues, rock becomes slightly dolomitic	33.5
	Leached Member--	
11090-11127	8. Dolomitic limestone: medium-brown, dolomitic microsparite and biomicrosparite; IIIB; rock is much like unit just above, but extensively dolomitized; streaks of mollusc-shell material occur from 11090-95. -- at 11090 - faintly burrowed microsparite, finely- and evenly-dolomitized throughout -- at 11113-16, 11121-23 - severely burrowed	37
11127-11144	9. Calcitic dolomite: very dark brownish-gray, hard dolomitized micrite; IIIB; permeability excellent; entire interval dolomitic, but patches are pure dolomite, no shell fragments. -- at 11144 - abrupt boundary from rock of above to 0.2" zone with carbonaceous, fine, wavy laminae, to mollusc-shell biomicrite of unit below	17
	Collapsed Member--	
11144-11155	10. Dolomitic limestone: very dark-gray, pyritic, dolomitic oyster biomicrite; IA and IIIA/B; lithology varies considerably. -- at 11144-46 - rock is non-dolomitic, contains disseminated pyrite -- at 11146-47 - oysters decrease, rock becomes severely burrowed, some limestone areas are medium-brown, medium-grain, mollusc-fragment biomicrite -- at 11147 - dolomite increases gradually downward -- at 11153-54 - scattered, disrupted 1/2"x2" hard crusts--light-gray, very fine-crystalline dolomite -- at 11154 - excellent Andros-type dolomitized hard crust	11
11155-11157.5	11. Dolomitic limestone: light-gray, hard, sucrosic, fine-crystalline, dolomitic micrite; IIIA/B; impregnated erratically with gilsonite, particularly at 11156	2.5
11157.5-11172	12. Dolomitic limestone; light-gray to medium-brown, hard, dolomitic, brecciated micrite and intramicrite; mostly IA, some IIIA/B; fragments consist of burrowed, pelleted soft-mud clasts and dolomitized hard crust fragments (0.1"-3"), contained in dark-gray carbonaceous, slightly dolomitic micrite. -- at 11166.5 - fragments become large (up to 8"), dolomitic, angular, and chaotic--this is apparently a collapse breccia -- at 11167.5 - note large sparry area with irregular boundaries; rock in this interval is fairly vuggy, porosity IIIB, IIID -- at 11169 - note small, soft-sediment slump in dolomitic micrite -- at 11169 - resume burrowed, black and brown, slightly dolomitic micrite; I/IIIA/B -- at 11172 - stylolite boundary	14.5
11172-11195	13. Dolomitic limestone: light brownish-gray to dark-brown, fine- to medium-crystalline micrite; IIIA/B, IIIB. -- at 11173 - extensive spar-filled, vein network in collapse feature -- at 11174.5 - resume black and brown, burrowed, dolomitic limestone; mud-filled sedimentary breccias also present, angular grains scattered throughout dolomitic matrix -- at 11177.5 - row of chert rosettes -- at 11186.5 - dolomite begins to diminish -- at 11187-87.5 - neatly and evenly-stratified, 1/2"-1" thick, slightly dolomitic graded beds of mollusc-fragment biomicrite--storm layers(?) -- at 11188 - small shell fragments scattered through light-brown micrite -- at 11191 - becomes very finely dolomitic, less burrowed, more homogeneous, very dense, with wavy laminations, disseminated pyrite, dolomite nearly gone	23
	Regional Dense Member--	
11195-11217	14. Limestone: very dark-brown, dense, hard, pyritic, slightly argillaceous, mollusc micrite and intramicrite; intraclasts are coated agglomerates of miliolid biomicrite; IA; molluscs are fragile small pelecypod shells. -- at 11205-07 - pyritic material increases, also dolomite content. -- at 11209-12 - slightly dolomitic -- at 11209-14 - abundant pellets and mud clasts, also many grains appear coated; interval becomes more clastic downward -- at 11217 - thin carbonaceous shaly interval	22
	KAINER FORMATION	
	Grainstone Member--	
11217-11248	15. Limestone: black and brown, dense, slightly pyritic, soft-pellet and clast intrasparite and miliolid biosparite and biomicrite; IA; rock burrowed in part, miliolids abundant, occur mostly in light-brown micrite; note intervals of apparent great or less winnowing and horizontal current streaks. -- at 11226-27.5 - black and brown, dense, burrowed, miliolid micrite; also some wavy carbonaceous laminae -- at 11246 - becomes churned, with carbonaceous laminae, muddier, with scattered whole-shell debris	31
11248-11255	16. Limestone: medium- to dark-brown, dense, hard, mollusc biomicrite; IA; shells are mostly large, whole Chondrodonta; miliolids few to numerous, scattered throughout matrix. -- at 11251.5-53.5 - coated shell fragments--pisolitic(?) -- at 11254-55 - shells gone, matrix as above, burrowed, miliolids common	7
11255-11290	17. Limestone: medium-brown, medium-grain, well-sorted, miliolid and mollusc-fragment biosparite; IIIA; some few intervals of shell debris, note also scattered aggregated, muddy composite grains (grapestone of Illing ?); minor constituents include dasyclad fragments, mud clasts; some earthy intervals are moderately porous; winnowing varies throughout interval	35
	Remarks: (a) Core depths are 10' higher than equivalent E log depths--this is borne out not only by top Edwards point, but also by porous streaks throughout the core that can be matched to sonic log porosity. (b) This is an excellent, complete core through the Person Formation.	

Depth (feet)		Thickness (feet)
	KARNES COUNTY; STANDARD OF TEXAS, NO. 3 G. YANTA (8); PERSON FIELD	
	EDWARDS GROUP	
	PERSON FORMATION	
	Collapsed Member--	
10877-10882	1. Calcitic dolomite: medium-gray (becoming dark brownish-gray in lower 2 feet), fine-grain, pelleted dolomitized mollusc-fragment biomicrite; IIIB/C; porosity formed by leached shell debris; thin hard crust at top of interval with thin channel deposit at base; white patches of anhydrite or white crystalline dolomite at 10880; rock has aspect of collapse	5
10882-10888	2. Dolomitic limestone: dark grayish-brown, burrowed, soft-pellet and skeletal intramicrosparite; IIIA; rock has distinctive, small-mottled aspect; matrix is microspar	6
10888-10897	3. Dolomite: medium to dark brownish-gray, burrowed in part, leached, fine-crystalline, dolomitized, fine-grain, mollusc-fragment biomicrite; IIIB/C; unit comprises one cycle as follows: -- at 10888-89 - thin dolomitized hard crust above 6" of rock that bears vague evidence of collapse and disruption -- at 10892-96 - finely-laminated micrite below grading up to fine-grain, mollusc-fragment biomicrite above; this rock then was exposed to produce a collapse-breccia in upper 2 feet of unit; voids filled by sparry calcite -- at 10896-97 - channel deposit with shells and soft-pellets at base (all limestone)	9
10897-10906	4. Dolomite: medium to dark brownish-gray, burrowed, fine-crystalline, very fine-skeletal, dolomitized micrite; IIIB; rock virtually featureless, massive. -- at 10897 - spar-filled vertical calcite vein	9
10906-10911	5. Dolomitic limestone: dark to medium-brown, burrowed, oyster microsparite; IA/B; similar to above, but much less dolomitic, scattered small oysters; very fine-crystalline microspar matrix	5
10911-10915	6. Dolomite: medium brownish-gray, vaguely but evenly laminated, fine-crystalline, fine-skeletal dolomitized micrite; IIIB; a few at 10912; distinct stylolite, burrows with a few large soft-clasts	4
	Regional Dense Member--	
10915-10921	7. Limestone: medium to dark grayish-brown, medium-grain, soft-pelleted and gastropod biomicrosparite; IA; note also possible green algae, a few shell fragments, vague wispy structures. -- at 10917-20 - gap	6
10921-10929	8. Limestone: dark to medium grayish-brown, wispy, burrowed, fine-grain, mollusc-fragment biomicrite; IA; debris mostly fragile shells, general aspect of rock similar to above; a few small oysters, grades into unit below	8
10929-10937	9. Limestone: dark to medium grayish-brown, burrowed, medium- to coarse-grain intramicrite; IA; clasts coated, reworked miliolid biomicrite and biosparite fragments similar to underlying Grainstone Bed of Kainer Member; they become progressively larger and more abundant downward	8
	KAINER FORMATION	
	Grainstone Member--	
10937-10953	10. Limestone: dark to medium grayish-brown, medium-grain, miliolid, pelleted, and clast intrasparite and intramicrite; IA; intact upper boundary not present in core; dark pellets abundant at 10937, 10940-42, 10948-53. -- at 10943 - few whole rudist shells--Toucasia(?) -- at 10948-51 - gap Remarks: (a) Core broken up badly, very small diameter (2"); although fairly complete, precise reconstruction was not possible. (b) Several very distinct thin (± 10') tidal flat cycles are present, similar to Shell No. 1 Roberts and Standard of Texas No. 1 Wiatrek, but in Collapsed Member rather than the Cyclic Member of the Person Formation.	16
	LASALLE COUNTY; TIDEWATER, NO. 2 WILSON (3); H & OB RR #307 SURVEY, A-800	
	EDWARDS GROUP	
	PERSON FORMATION	
8892-8902	1. Limestone: light grayish-brown, dense, very fine-grain, well-sorted, mollusc-fragment biomicrite; IA; rock homogeneous, essentially featureless throughout, with a few vague burrows at 8895-97; slightly darker, muddy streak at 8896; some spar-filled fractures at 8893, 8896 lower boundary gradational	10
8902-8912	2. Limestone: light grayish-brown, dense, medium- to fine-grain, moderately-sorted, mollusc-fragment biomicrite; IA; the rock of above becoming coarser-grain and winnowed; ocal scour surfaces at 8902, 8904, 8905, 8908 and 8909; many grains are coated	10
8912-8924	3. Limestone: medium grayish-brown, dense, burrowed, medium- to coarse-grain, poorly-sorted, muddy foram and rudist biosparite; IA; first large shell fragments here: Toucasia, Chondrodonta; note also scattered miliolids, Dictyoconus; many grains still coated; still essentially the rock of above becoming slightly darker with large shells. -- at 8922-24 - shell material has been leached away, later filled-in with sparry calcite	12
8924-8942	4. Limestone: medium grayish-brown, dense, fine-grain, moderately-sorted, mollusc-fragment and miliolid biosparite; IA; horizontal current streaks throughout; no large shells; note very coarse-grain streaks at 8925-926, 8927, 8931, 8934, 8939	18
	MCMULLEN COUNTY: TENNECO, NO. 1 JAMBERS (2); G C & S F RR SURVEY #499	
	GEORGETOWN FORMATION	
11157-11161	1. Limestone: medium grayish-brown, dense, Globigerina and calcisphere micrite; IA; scattered pyrite; lower boundary is abrupt, undulose (nearly 1" of relief), with carbonaceous and pyritic streak, weathered pebbles of Georgetown lithology in lower 6"; Edwards below is bored	4
	EDWARDS GROUP	
	PERSON FORMATION	
11161-11174	2. Limestone: medium-brown, dense, pelleted, Toucasia and miliolid biomicrite; IA; no microspar -- at 11162 - common spar-filled Cladophyllia -- at 11167-79 - large caprinids	13
11174-11178	3. Limestone: light-gray, very coarse-grain, moderately-sorted, rudist-fragment biosparite; IA/D; shells have undergone complex diagenesis involving leaching and spar-filling; a few microspar pellets; dead oil	4
11178-11187	4. Limestone: medium- to dark-brown, wispy, miliolid and pelleted micrite; IA; few small caprinid shells	9
11187-11210	5. Limestone: medium-tan to dark-brown, burrowed, soft-pelleted, Toucasia and miliolid biomicrite; IA; other features: -- at 11192-93 - white chert replacement areas -- at 11193-94 - large, whole, Toucasia shells, rock becomes darker -- at 11196-97 - scattered Toucasia -- at 11200-01 - abundant large, whole Toucasia and caprinids, light brown chert nodule at base -- at 11201-10 - becomes lighter again with common whole Toucasia	23
11210-11215	6. Limestone: light-tan, medium-grain, well-sorted, pelleted, mollusc-fragment biosparite; IA; scattered miliolids; large patch of dead oil in bottom foot	5
11215-11225	7. Limestone: light-brown, medium-grain, burrowed, miliolid, pelleted intramicrite; IA; burrows are filled with molluscan biosparite; scattered Toucasia from 11219-25	10
11225-11242	8. Limestone: medium to dark brownish-gray, dense, wispy, burrowed, pelleted, miliolid biomicrite; IA. -- at 11226, 11234, 11242 - large light grayish-brown chert nodules -- at 11236 - large Chondrodonta -- at 11237-41 - grades to miliolid and mollusc-fragment biosparite; note fine current streaks, few large shells at 11237	17
11242-11256	9. Limestone: light-tan, dense, wispy, burrowed, pelleted, miliolid biomicrite; IA. -- at 11250 - few large Toucasia shells, rock becomes medium- to dark-gray -- at 11252-53 - dark-gray, banded chert nodule -- at 11253-54 - dark-brown, Cladophyllia micrite. -- at 11254-56 - dark-gray, banded chert	14
11256-11269	10. Limestone: medium to dark grayish-brown, moderately-sorted, medium- to fine-grain, pelleted, miliolid biosparite; IA; burrowed in part, also with horizontal current streaks. -- at 11258-59 - very dark interval of blocky spar, some dead oil -- at 11269 - scattered dolomite rhombs, very wispy, abundant miliolids	13

Depth (feet)		Thickness (feet)
11269-11271	11. Limestone: very dark brownish-gray, dense, wispy, dense, fissile, carbonaceous micrite; IA; few shelly streaks, few oyster shells, lower boundary gradational -- at 11270 - black chert layer 2" thick	2
11271-11277	12. Limestone: dark brownish-gray, dense, highly burrowed, pelleted, miliolid biomicrite; IA; scattered large shells, few wisps, dead oil	6
11277-11288.5	13. Limestone: medium to dark grayish-brown, dense, highly burrowed, Monopleura, oyster and caprinid muddy biosparite; IA; matrix with miliolids, pellets, etc; gradually becomes light-tan downward; scattered dolomite rhombs	11.5
11288.5-11291.5	14. Chert and limestone: light grayish-brown chert nodules and pelleted, miliolid biomicrite; IA, appears highly burrowed; chert is replaced biomicrite and biosparite	3
11291.5-11299	15. Limestone: medium to dark grayish-brown, dense, burrowed, pelleted caprinid biomicrite, IA, matrix with pellets and and miliolids; caprinids, large, whole, spar-replaced	7.5
11299-11309	16. Gap	10
11309-11316	17. Chert and limestone: very dark-brown, dense, wispy, pelleted micrite and chert; in lower 5 feet chert occurs as light-brown, smaller (1"-2") nodules	7
11316-11328	18. Limestone: light grayish-brown, medium-grain, well-sorted, miliolia and mollusc-fragment biosparite; I/IIIA, few large clam shells and snails; current streaks, becomes darker in lower 2 feet	12
11328-11335	19. Limestone: medium to dark grayish-brown, dense, highly burrowed, pelleted, miliolid biomicrite; IA; in bottom 3 feet becomes light grayish-brown, shelly biosparite	7
11335-11367	20. Gap	32
	Regional Dense Member--	
11367-11374	21. Argillaceous limestone: dark grayish-brown, dense, wispy, burrowed, slightly dolomitic, pyritic, argillaceous, pelleted, mollusc micrite; IA. -- at 11370 - loses clay, becomes dense micrite, burrowed -- at 11373 - clasts and apparently reworked pebbles	7
	KAINER FORMATION	
	Grainstone Member--	
11374-11443	22. Limestone: medium-brown, dense, medium-grain, well-sorted, miliolid intrasparite; IA; clasts are coated aggregates of miliolid biomicrite; other features: -- at 11380-87 - scattered Toucasia -- at 11390-401 - darker, muddier--grades to wispy intramicrite; scattered Toucasia at 11396 -- at 11401-10 - lighter-colored, coarser-grain, current streaked, less micrite -- at 11410-17 - as at 11390-401 plus large Chondrodonta -- at 11417-43 - as at 11401-410 except for dense micrite and oysters at 11435	69
	Remarks: a. Core 25 feet low to equivalent points on electric log. b. Very little dolomite through Person Formation. c. Except for Regional Dense Member, Karnes County Person Formation sequence is not recognizable here. d. Abundant chert. e. Even this far away from axis of San Marcos Platform, top of Edwards is disconformable.	

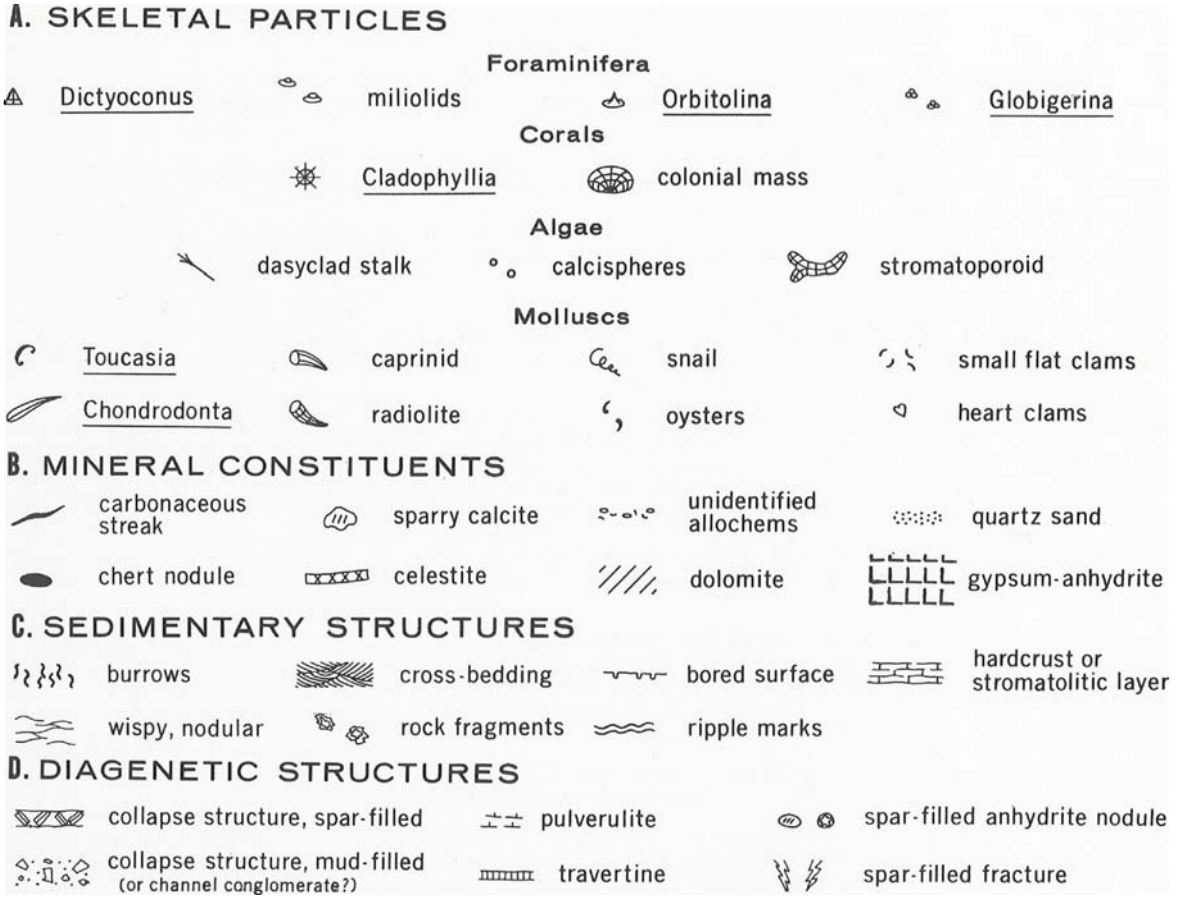
WILSON COUNTY; SUN, NO. 2 BAIN (1); N. F. ROBERTS SURVEY

	GEORGETOWN FORMATION	
4562-4599	1. Limestone: light-gray, fine-grain, moderately-sorted, glauconitic, foram biomicrite; IA, skeletal particles include Globigerina, Textularia, calcispheres, fragile clams and oysters, intensely burrowed with scattered streaks of clasts, also thin black, carbonaceous, wispy streaks. -- at 4564 - six-inch interval of weathered, dark-gray micrite clasts, also abundant non-calcareous, clear grains that don't look like quartz, may be detrital dolomite -- at 4568-71 - intense burrowing plus clasts; also irregular, black, thin wispy carbonaceous streaks -- at 4574-82 - influx of oysters (still with Globigerina), intensely churned and burrowed -- at 4582-83 - flat large (3") oysters, also weathered green clasts 1"-2" across -- at 4583 - similar to 4574-82 but somewhat more wispy -- at 4594 - becomes more massive, less wispy and burrowed, slightly more bioclastic -- at 4598 - two black carbonaceous streaks each 1" thick; below the lower one is Edwards; contact is abrupt, bored	37
	EDWARDS GROUP	
	PERSON FORMATION	
	Cyclic Member--	
4599-4618	2. Dolomitic limestone: light-tan, dolomitic, miliolid and mollusc biomicrite; IA, miliolids less abundant below 4601; rocks are more granular, light-cream colored; non-dolomitic above 4604; below 4611 rock appears granular, sucrosic, rotten, with occasional large clasts; scattered miliolids	19
4618-4625	3. Dolomite: light-gray, wispy, burrowed, dolomitized, pelleted and clast intramicrite; IIIB/C; mostly a supratidal and collapse-breccia sequence; at 4618 note distinct collapse with scattered patches of anhydrite in rock; unit has general cyclic aspect previously noted in cores of Shell No. 1 Roberts, Standard of Texas No. 1 Wiatrek and others: -- at 4618-19 - collapse breccia -- at 4619-21 - dolomitized micrite and intramicrite with wispy, current bedding and anhydrite patches -- at 4621-23 - severely-burrowed dolomitized micrite -- at 4623-23.5 - stromatolite crust -- at 4623.5-25 - featureless dolomitized micrite	7

APPENDIX C—MEASURED SECTIONS

Twenty-four measured sections are contained in this appendix. Boundaries of formations, members, and beds are indicated on a location map for each section. These sections together with the geologic map (Pl. 1) and descriptions of localities (Appendix D) constitute the documentation on which interpretations of the surface geology are based.

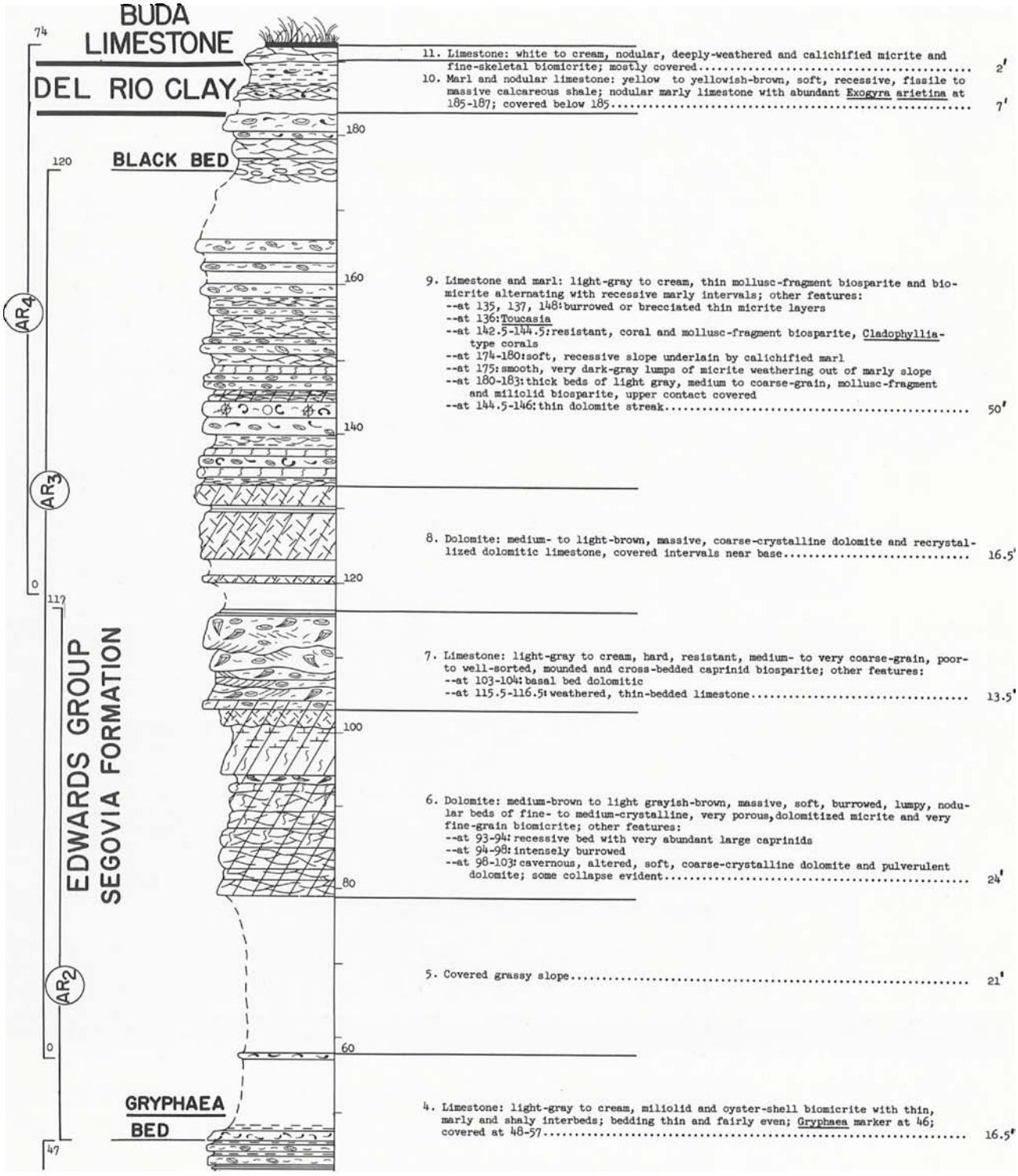
Graphic symbols are the same as those used in the generalized columnar sections (figs. 9, 10, 22, 24); explanation of these symbols is repeated below.

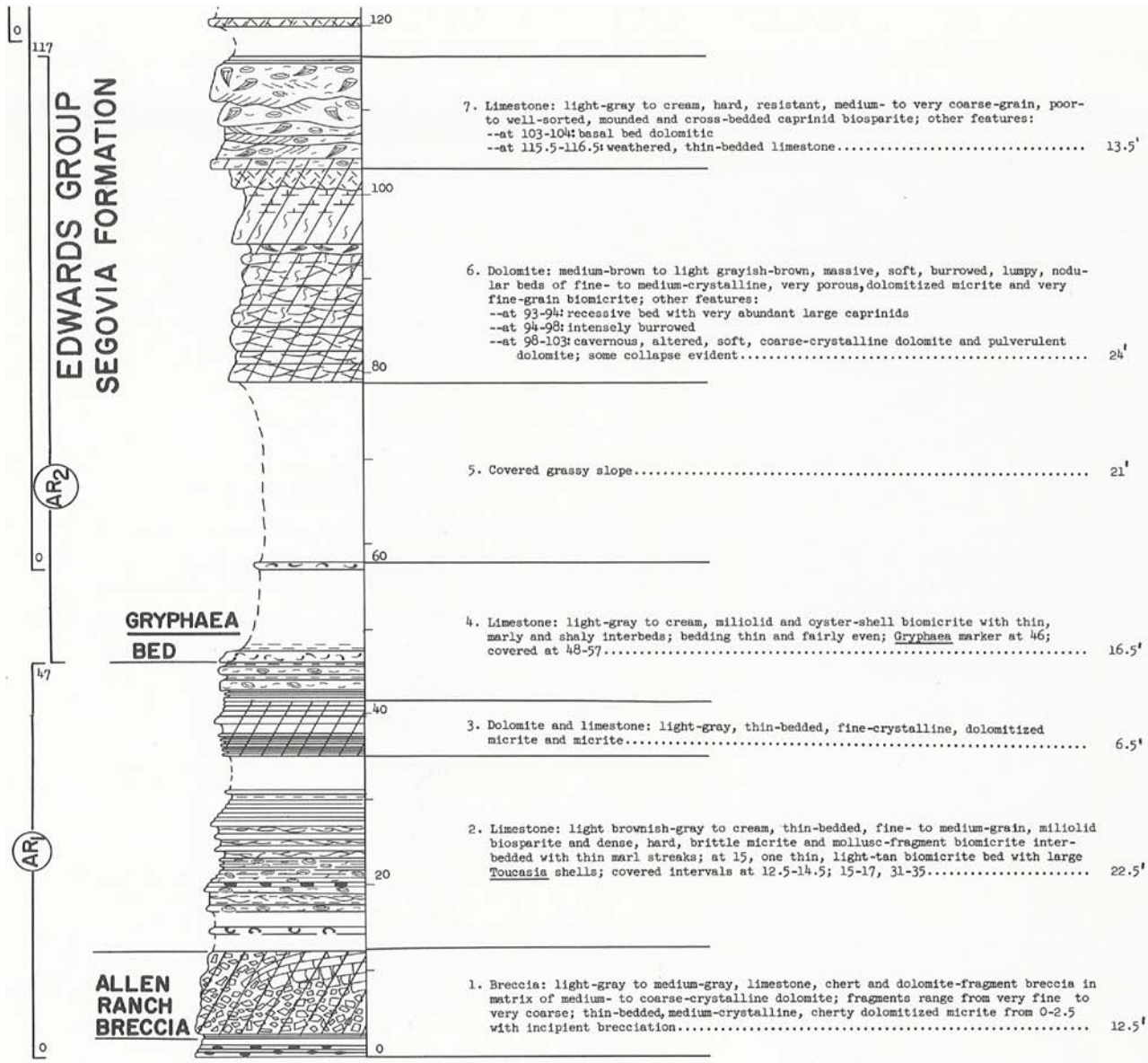


Inasmuch as most sections were measured in highway road cuts, the index maps should suffice to locate sections in the field. Some of the sections or segments, however, are more remote and the following notes augment the index maps.

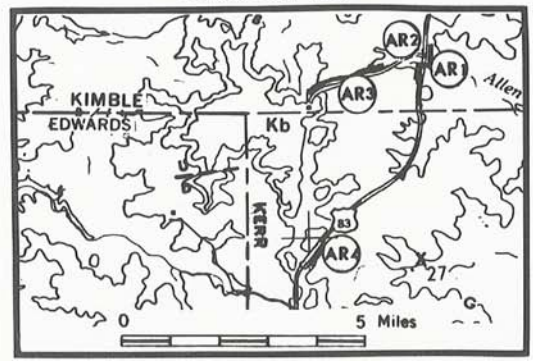
Edwards Creek:	Segments 1, 2, and 3 measured along Edwards Creek near north-south graded ranch road as shown on map; not painted.
Kerrville:	Segment 2 measured on southwest side of prominent knob 1/2 mile ESE of barns on Sweathelm ranch about 6 miles northeast of Kerrville; painted.
Louis Real:	Measured on hillside one mile southwest of Louis Real ranch headquarters; section begins in deep draw 500 yards south-southeast of red barn and proceeds north up the draw and then to the top of the hill; painted.
Mountain Home:	Segment 1 measured along west-facing bluff on Johnson Creek at roadside park on Texas 27 as shown on map; not painted. Segment 4 begins 300 yards south of ranch road crossing, in creek bed 1/4 mile northeast of R. A. Sproul ranch headquarters about 4 miles west-northwest of Mountain Home post office and proceeds west up creek bed; not painted.
North Fork Composite:	Segment NF measured up south-facing bluff on North Fork of Guadalupe River beginning 100 yards downstream from low water crossing on Texas 1340 8 miles (by road) west of Hunt; painted.
	Segment TP_1 measured on east bank of North Fork of Guadalupe River where it makes a hairpin turn 1/2 mile east of Tommy Prior ranch headquaters; painted.
	Segment TP_2 begins beside graded road, in dry creek bed 0.8 mile north of Tommy Prior ranch headquarters and proceeds west up hillside; painted.
	Segment SF measured on bluffs on north side of branch of upper North Fork of Guadalupe River on Bobby French's South Fork ranch; section begins at east end of bluff, proceeds up the bluff to 60', then offsets 1/4 mile west and continues to top of bald hill (see map); painted. For permission see Dick Harper, foreman (residence about 1 mile east of Texas 39-187 intersection).
Orr Ranch:	Segment 1 begins in dry creek bed 100 yards east of Morriss ranch headquarters and proceeds east up hill and across fence to 105'; painted. Offset on 89' (Orr Ranch Bed) about 1 mile south to ranch road at bottom of draw 300 yards northeast of barn 1/2 mile north-west of W. E. Orr ranch headquarters; segment 2 proceeds eastward to field at top of hill; painted.
Paint Creek:	Section begins in bed of Paint Creek on Shellmeyer ranch about 1 mile north of ranch headquarters and proceeds west up hill beside ranch road to Gryphaea Bed at 153; painted.
South Llano:	Segment 1 begins on Coke Stevenson ranch in bed of South Llano River and proceeds west up deep draw to U.S. 377; painted. Segment 2 begins in next draw north and proceeds north up hillside, then offsets into highway road cut on bed at 110; painted. Segment 3 merely determines Doctor Burt-Gryphaea Bed interval on hillside about 1 mile west of U.S. 377 (see map).
Stieler Ranch:	Segment 2 begins in steep gully 50 yards west of U.S. 87 and proceeds west 100 yards to top of hill on Stieler ranch; painted (see map).
Turkey Knob:	Segment TK located on west side of high hill on Nordan ranch about 1/2 mile west of old Ingenhuett ranch headquarters; section begins in deep gully about 1 mile west of hilltop, passes east to top of hill; painted.
West Sister Creek:	Segment DR measured about 1/4 mile west of main ranch road 3 miles south of DuPuy ranch headquarters; section begins on west side of hill in gully and proceeds east to top of hill; not painted.

ALLEN RANCH COMPOSITE

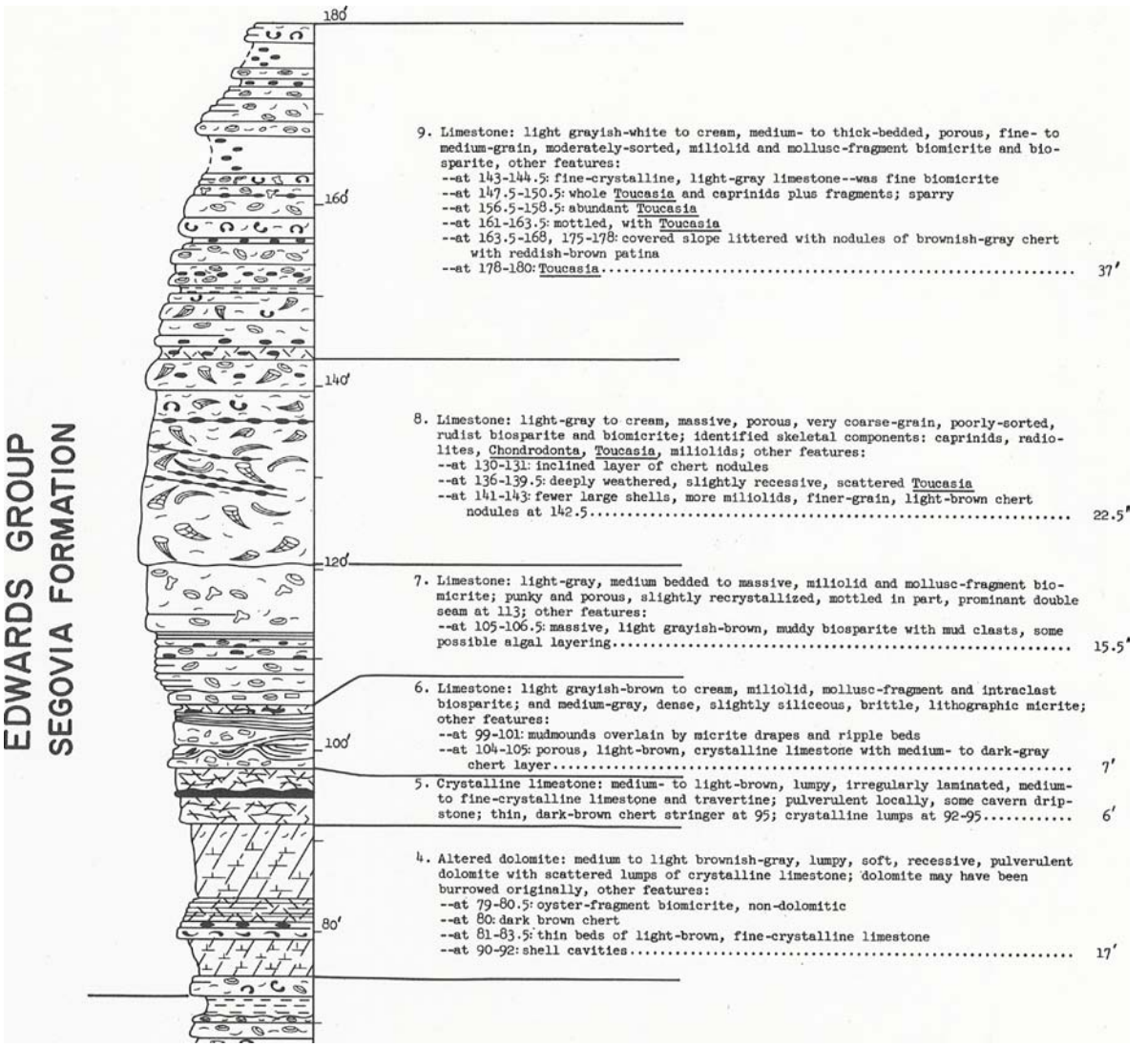




LOCATION MAP



BEE CAVES RANCH



9. Limestone: light grayish-white to cream, medium- to thick-bedded, porous, fine- to medium-grain, moderately-sorted, miliolid and mollusc-fragment biomicrite and biosparite, other features:
--at 143-144.5: fine-crystalline, light-gray limestone--was fine biomicrite
--at 147.5-150.5: whole Toucasia and caprinids plus fragments; sparry
--at 156.5-158.5: abundant Toucasia
--at 161-163.5: mottled, with Toucasia
--at 163.5-168, 175-178: covered slope littered with nodules of brownish-gray chert with reddish-brown patina
--at 178-180: Toucasia..... 37'

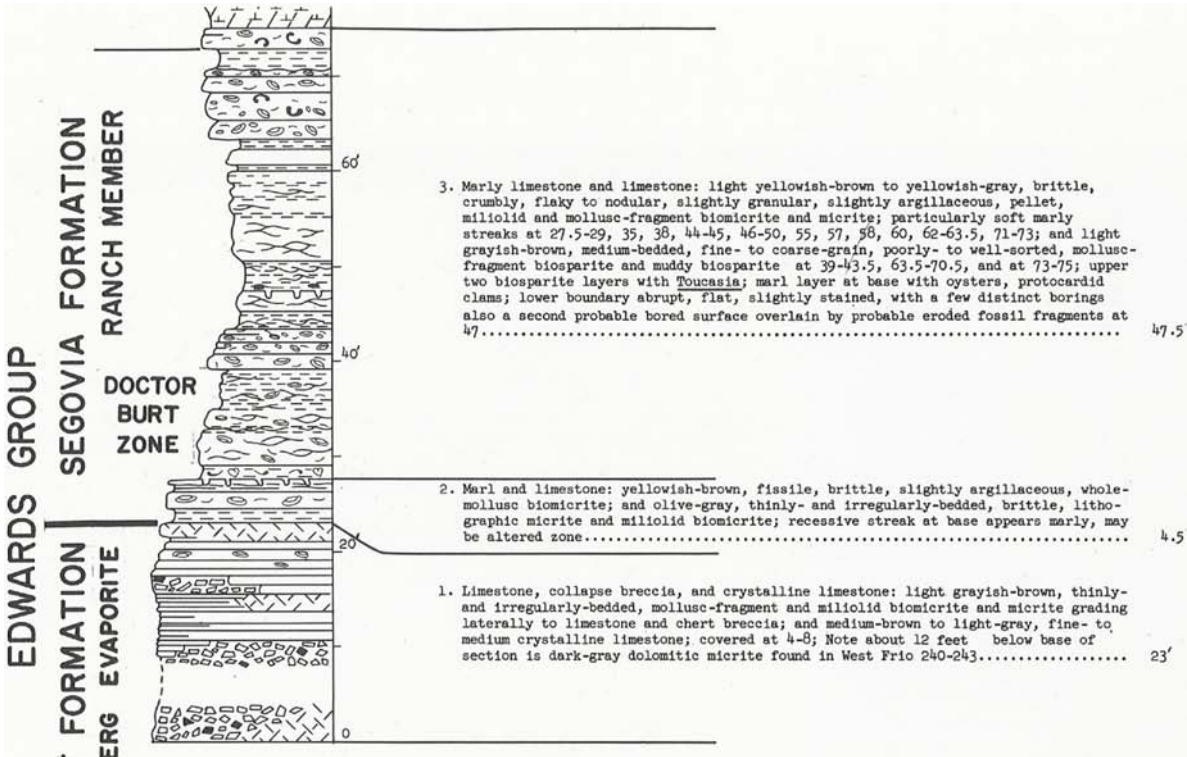
8. Limestone: light-gray to cream, massive, porous, very coarse-grain, poorly-sorted, rudist biosparite and biomicrite; identified skeletal components: caprinids, radiolites, Chondrodonta, Toucasia, miliolids; other features:
--at 130-131: inclined layer of chert nodules
--at 136-139.5: deeply weathered, slightly recessive, scattered Toucasia
--at 141-143: fewer large shells, more miliolids, finer-grain, light-brown chert nodules at 142.5..... 22.5'

7. Limestone: light-gray, medium bedded to massive, miliolid and mollusc-fragment biomicrite; punky and porous, slightly recrystallized, mottled in part, prominant double seam at 113; other features:
--at 105-106.5: massive, light grayish-brown, muddy biosparite with mud clasts, some possible algal layering..... 15.5'

6. Limestone: light grayish-brown to cream, miliolid, mollusc-fragment and intraclast biosparite; and medium-gray, dense, slightly siliceous, brittle, lithographic micrite; other features:
--at 99-101: mudmounds overlain by micrite drapes and ripple beds
--at 104-105: porous, light-brown, crystalline limestone with medium- to dark-gray chert layer..... 7'

5. Crystalline limestone: medium- to light-brown, lumpy, irregularly laminated, medium- to fine-crystalline limestone and travertine; pulverulent locally, some cavern dripstone; thin, dark-brown chert stringer at 95; crystalline lumps at 92-95..... 6'

4. Altered dolomite: medium to light brownish-gray, lumpy, soft, recessive, pulverulent dolomite with scattered lumps of crystalline limestone; dolomite may have been burrowed originally, other features:
--at 79-80.5: oyster-fragment biomicrite, non-dolomitic
--at 80: dark brown chert
--at 81-83.5: thin beds of light-brown, fine-crystalline limestone
--at 90-92: shell cavities..... 17'

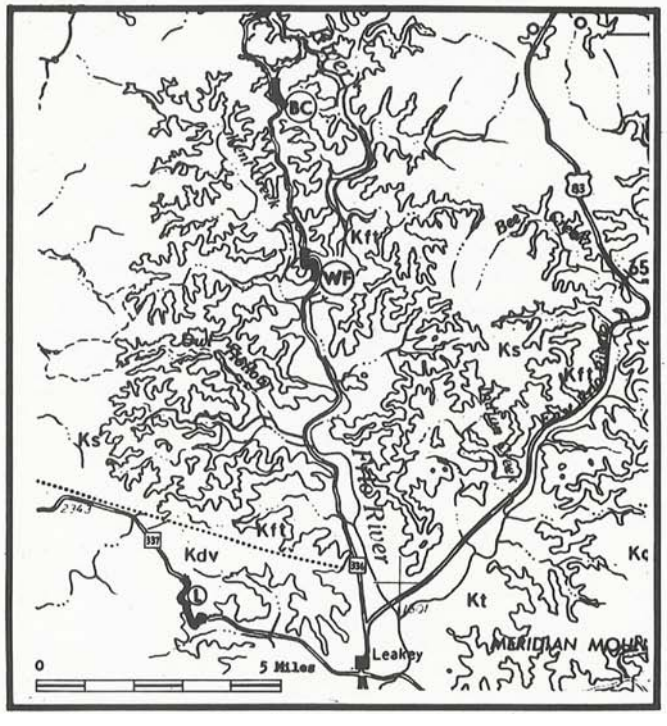


3. Marly limestone and limestone: light yellowish-brown to yellowish-gray, brittle, crumbly, flaky to nodular, slightly granular, slightly argillaceous, pellet, miliolid and mollusc-fragment biomicrite and micrite; particularly soft marly streaks at 27.5-29, 35, 38, 44-45, 46-50, 55, 57, 58, 60, 62-63.5, 71-73; and light grayish-brown, medium-bedded, fine- to coarse-grain, poorly- to well-sorted, mollusc-fragment biosparite and muddy biosparite at 39-43.5, 63.5-70.5, and at 73-75; upper two biosparite layers with Toucasia; marl layer at base with oysters, protocardid clams; lower boundary abrupt, flat, slightly stained, with a few distinct borings also a second probable bored surface overlain by probable eroded fossil fragments at 47..... 47.5'

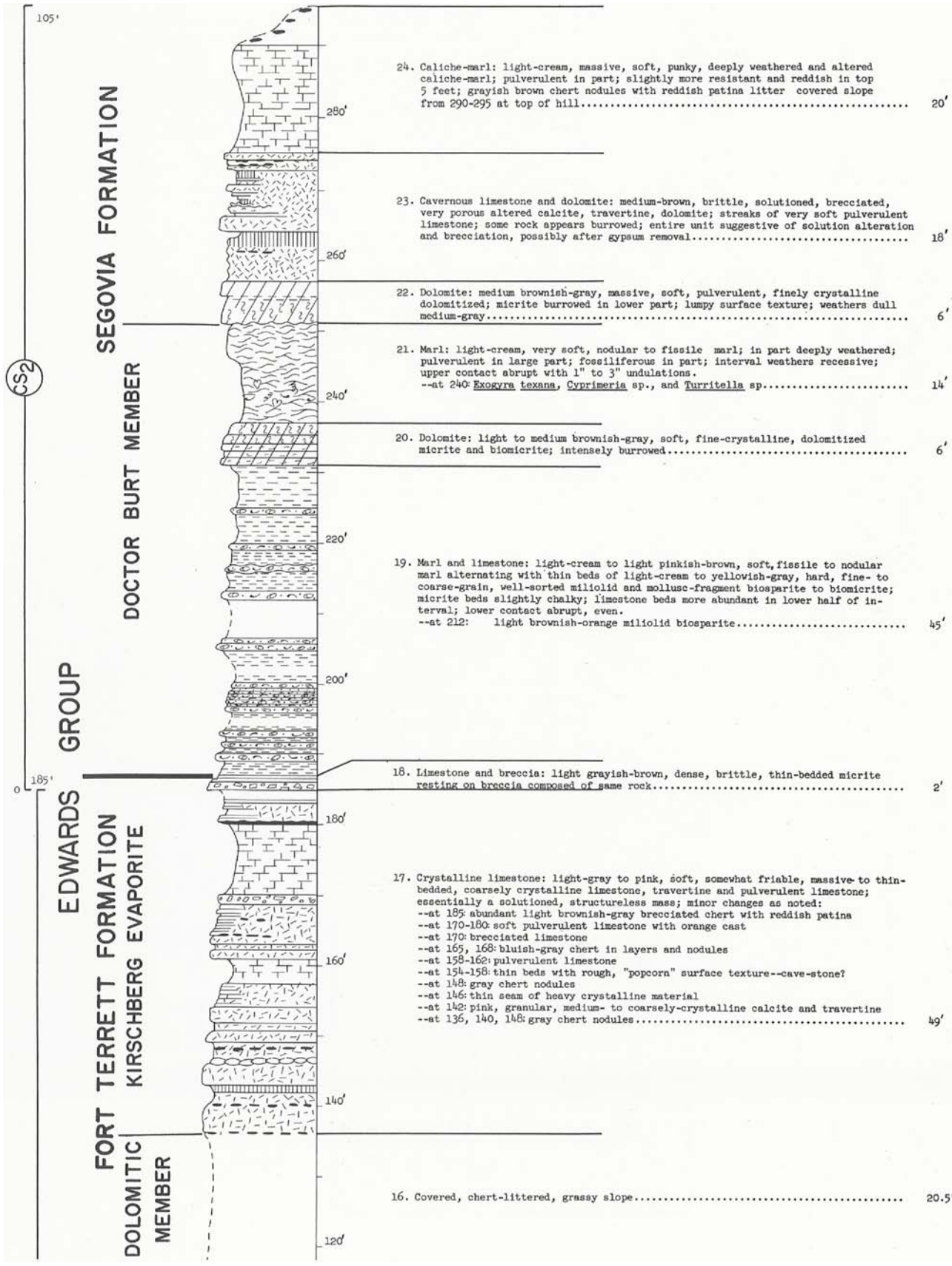
2. Marl and limestone: yellowish-brown, fissile, brittle, slightly argillaceous, whole-mollusc biomicrite; and olive-gray, thinly- and irregularly-bedded, brittle, litho-graphic micrite and miliolid biomicrite; recessive streak at base appears marly, may be altered zone..... 4.5'

1. Limestone, collapse breccia, and crystalline limestone: light grayish-brown, thinly- and irregularly-bedded, mollusc-fragment and miliolid biomicrite and micrite grading laterally to limestone and chert breccia; and medium-brown to light-gray, fine- to medium crystalline limestone; covered at 4-8; Note about 12 feet below base of section is dark-gray dolomitic micrite found in West Frio 240-243..... 23'

LOCATION MAP



CHERRY SPRING



24. Caliche-marl: light-cream, massive, soft, punky, deeply weathered and altered caliche-marl; pulverulent in part; slightly more resistant and reddish in top 5 feet; grayish brown chert nodules with reddish patina litter covered slope from 290-295 at top of hill..... 20'

23. Cavernous limestone and dolomite: medium-brown, brittle, solutioned, brecciated, very porous altered calcite, travertine, dolomite; streaks of very soft pulverulent limestone; some rock appears burrowed; entire unit suggestive of solution alteration and brecciation, possibly after gypsum removal..... 18'

22. Dolomite: medium brownish-gray, massive, soft, pulverulent, finely crystalline dolomitized; micrite burrowed in lower part; lumpy surface texture; weathers dull medium-gray..... 6'

21. Marl: light-cream, very soft, nodular to fissile marl; in part deeply weathered; pulverulent in large part; fossiliferous in part; interval weathers recessive; upper contact abrupt with 1" to 3" undulations.
--at 240: Exogyra texana, Cyprimeria sp., and Turritella sp..... 14'

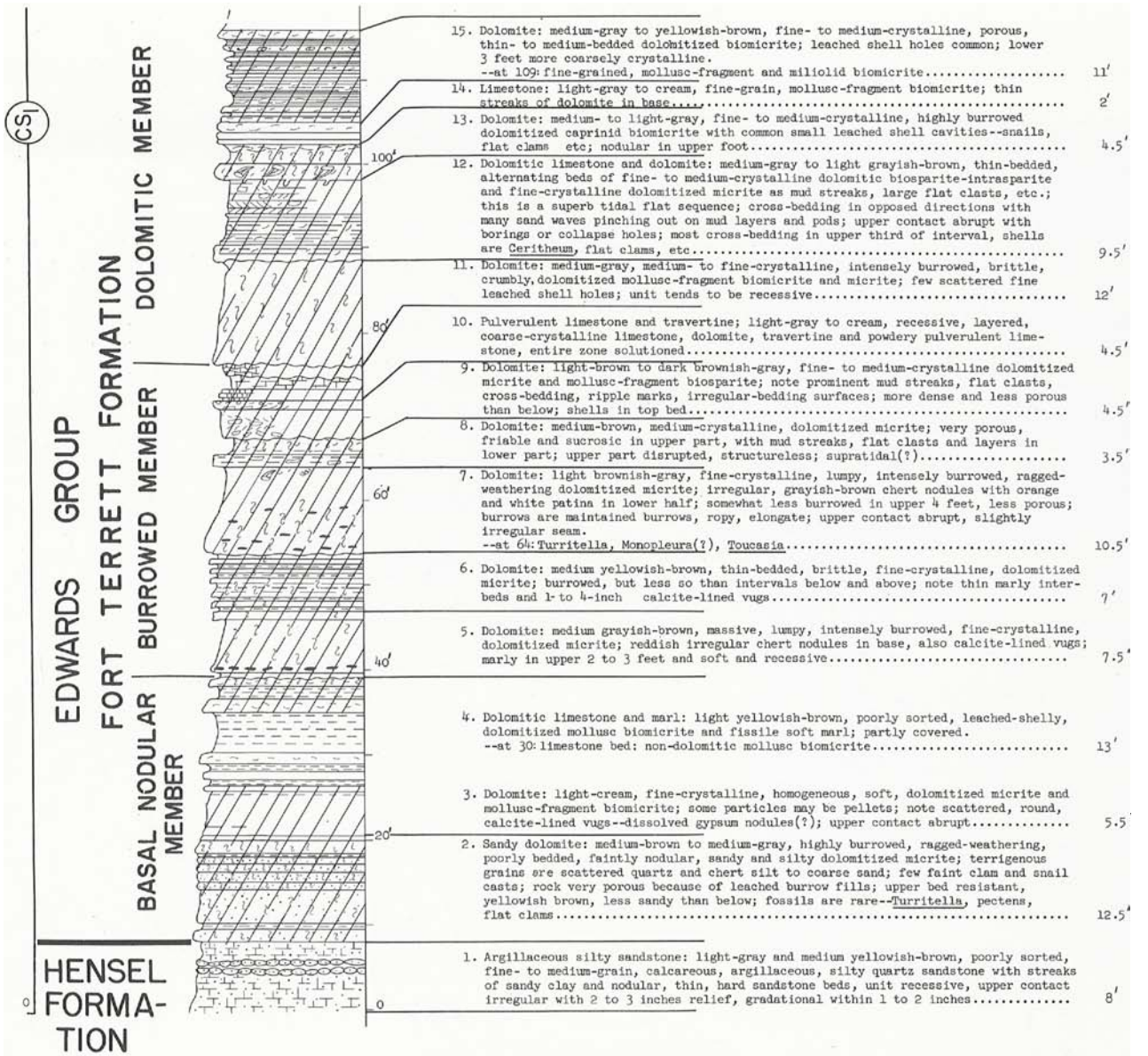
20. Dolomite: light to medium brownish-gray, soft, fine-crystalline, dolomitized micrite and biomicrite; intensely burrowed..... 6'

19. Marl and limestone: light-cream to light pinkish-brown, soft, fissile to nodular marl alternating with thin beds of light-cream to yellowish-gray, hard, fine- to coarse-grain, well-sorted miliolid and mollusc-fragment biosparite to biomicrite; micrite beds slightly chalky; limestone beds more abundant in lower half of interval; lower contact abrupt, even.
--at 212: light brownish-orange miliolid biosparite..... 45'

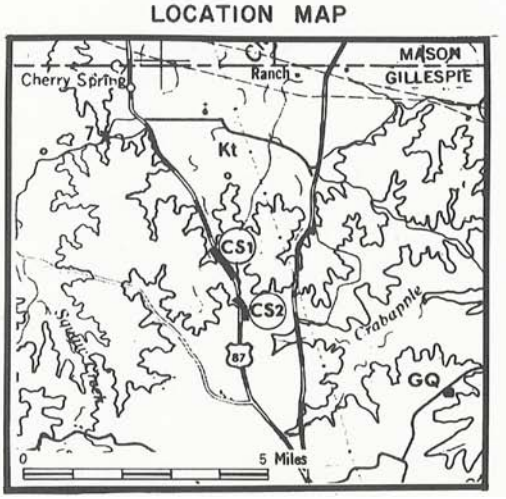
18. Limestone and breccia: light grayish-brown, dense, brittle, thin-bedded micrite resting on breccia composed of same rock..... 2'

17. Crystalline limestone: light-gray to pink, soft, somewhat friable, massive to thin-bedded, coarsely crystalline limestone, travertine and pulverulent limestone; essentially a solutioned, structureless mass; minor changes as noted:
--at 185: abundant light brownish-gray brecciated chert with reddish patina
--at 170-180: soft pulverulent limestone with orange cast
--at 170: brecciated limestone
--at 165, 168: bluish-gray chert in layers and nodules
--at 158-162: pulverulent limestone
--at 154-158: thin beds with rough, "popcorn" surface texture--cave-stone?
--at 148: gray chert nodules
--at 146: thin seam of heavy crystalline material
--at 142: pink, granular, medium- to coarsely-crystalline calcite and travertine
--at 136, 140, 148: gray chert nodules..... 49'

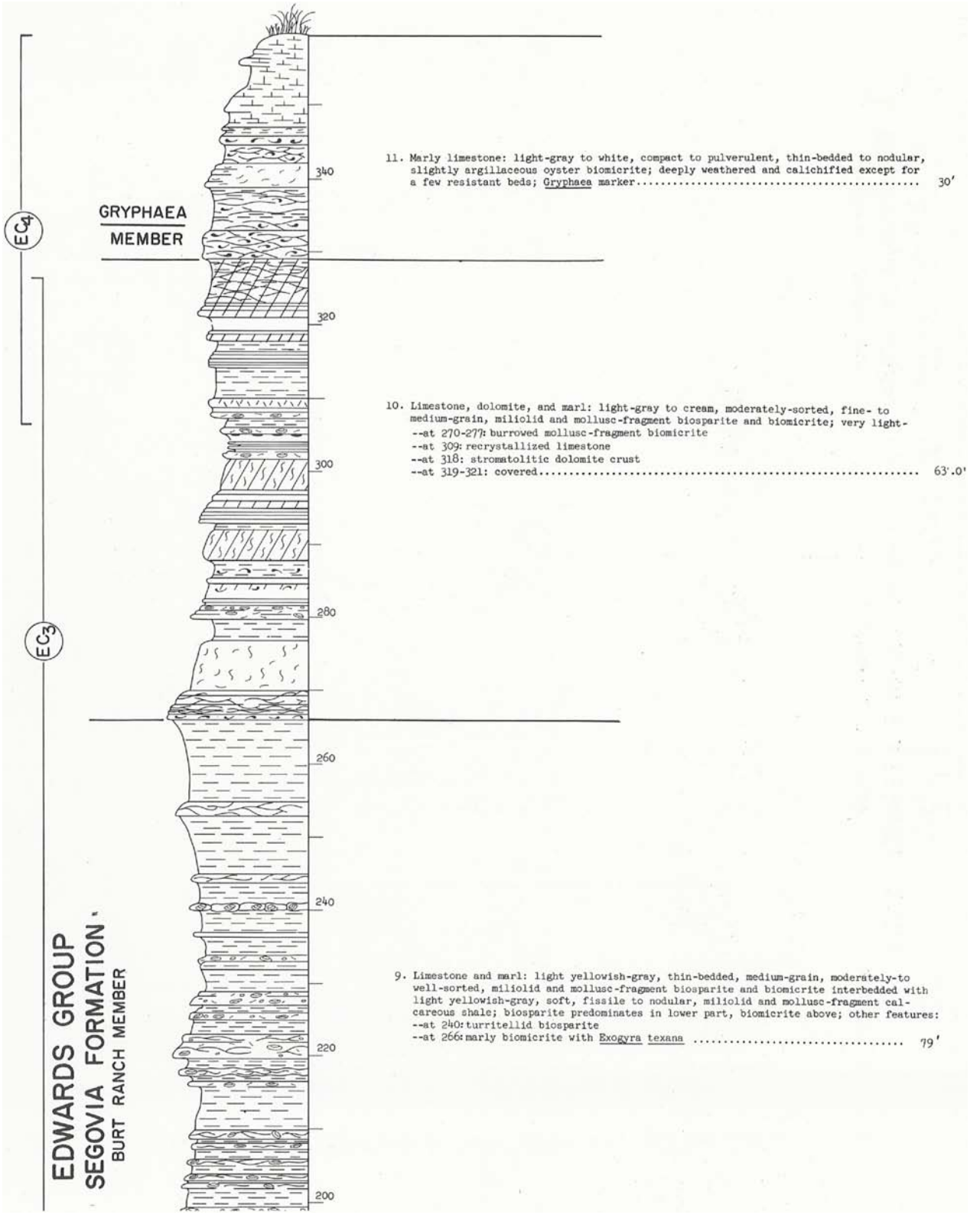
16. Covered, chert-littered, grassy slope..... 20.5'



LOCATION MAP



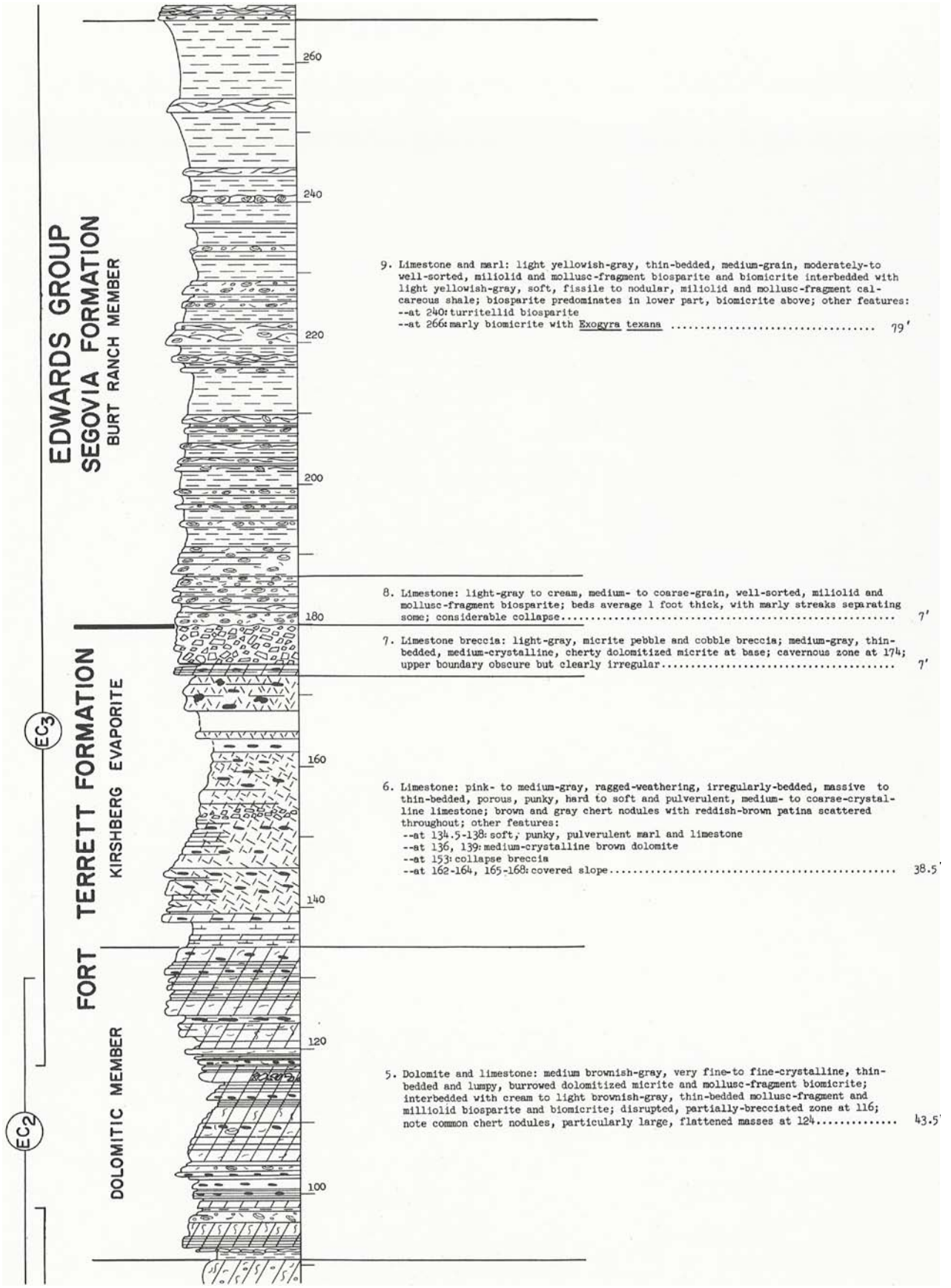
EDWARDS CREEK



11. Marly limestone: light-gray to white, compact to pulverulent, thin-bedded to nodular, slightly argillaceous oyster biomicrite; deeply weathered and calichified except for a few resistant beds; Gryphaea marker..... 30'

10. Limestone, dolomite, and marl: light-gray to cream, moderately-sorted, fine- to medium-grain, miliolid and mollusc-fragment biosparite and biomicrite; very light-
--at 270-277: burrowed mollusc-fragment biomicrite
--at 309: recrystallized limestone
--at 318: stromatolitic dolomite crust
--at 319-321: covered..... 63'.0'

9. Limestone and marl: light yellowish-gray, thin-bedded, medium-grain, moderately-to well-sorted, miliolid and mollusc-fragment biosparite and biomicrite interbedded with light yellowish-gray, soft, fissile to nodular, miliolid and mollusc-fragment calcareous shale; biosparite predominates in lower part, biomicrite above; other features:
--at 240: turritellid biosparite
--at 266: marly biomicrite with Exogyra texana ..... 79'



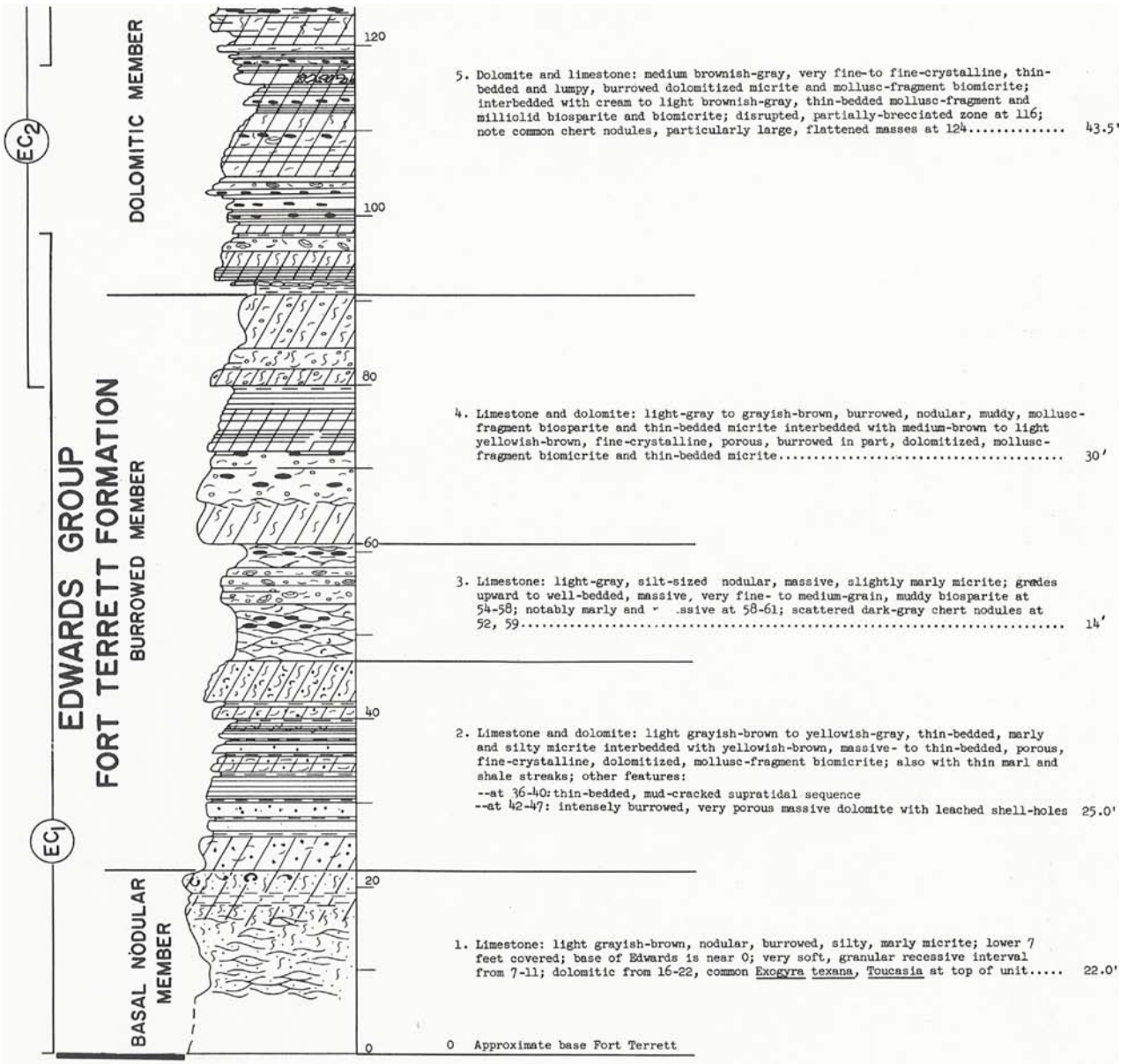
9. Limestone and marl: light yellowish-gray, thin-bedded, medium-grain, moderately-to well-sorted, miliolid and mollusc-fragment biosparite and biomicrite interbedded with light yellowish-gray, soft, fissile to nodular, miliolid and mollusc-fragment calcareous shale; biosparite predominates in lower part, biomicrite above; other features:
--at 240: turritellid biosparite
--at 266: marly biomicrite with Exogyra texana ..... 79'

8. Limestone: light-gray to cream, medium- to coarse-grain, well-sorted, miliolid and mollusc-fragment biosparite; beds average 1 foot thick, with marly streaks separating some; considerable collapse..... 7'

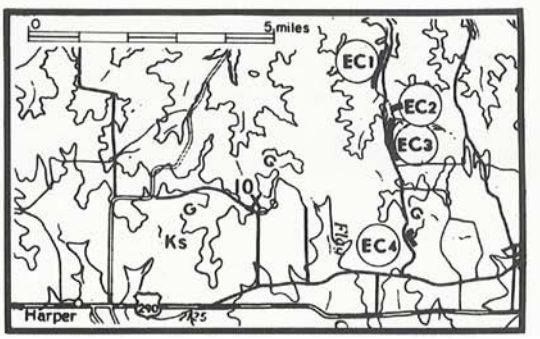
7. Limestone breccia: light-gray, micrite pebble and cobble breccia; medium-gray, thin-bedded, medium-crystalline, cherty dolomitized micrite at base; cavernous zone at 174; upper boundary obscure but clearly irregular..... 7'

6. Limestone: pink- to medium-gray, ragged-weathering, irregularly-bedded, massive to thin-bedded, porous, punky, hard to soft and pulverulent, medium- to coarse-crystalline limestone; brown and gray chert nodules with reddish-brown patina scattered throughout; other features:
--at 134.5-138: soft, punky, pulverulent marl and limestone
--at 136, 139: medium-crystalline brown dolomite
--at 153: collapse breccia
--at 162-164, 165-168: covered slope..... 38.5'

5. Dolomite and limestone: medium brownish-gray, very fine-to fine-crystalline, thin-bedded and lumpy, burrowed dolomitized micrite and mollusc-fragment biomicrite; interbedded with cream to light brownish-gray, thin-bedded mollusc-fragment and milliolid biosparite and biomicrite; disrupted, partially-brecciated zone at 116; note common chert nodules, particularly large, flattened masses at 124..... 43.5'



LOCATION MAP



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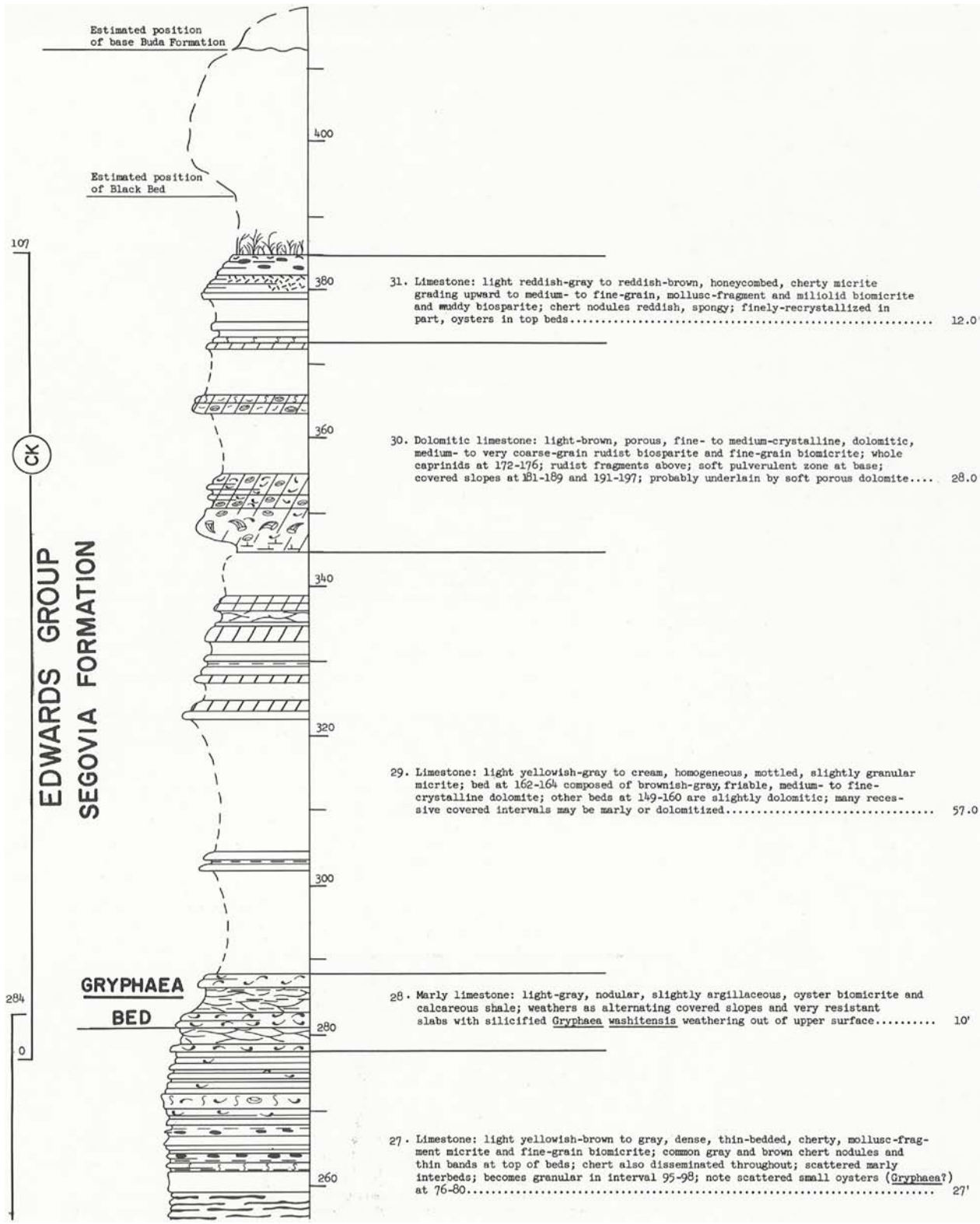
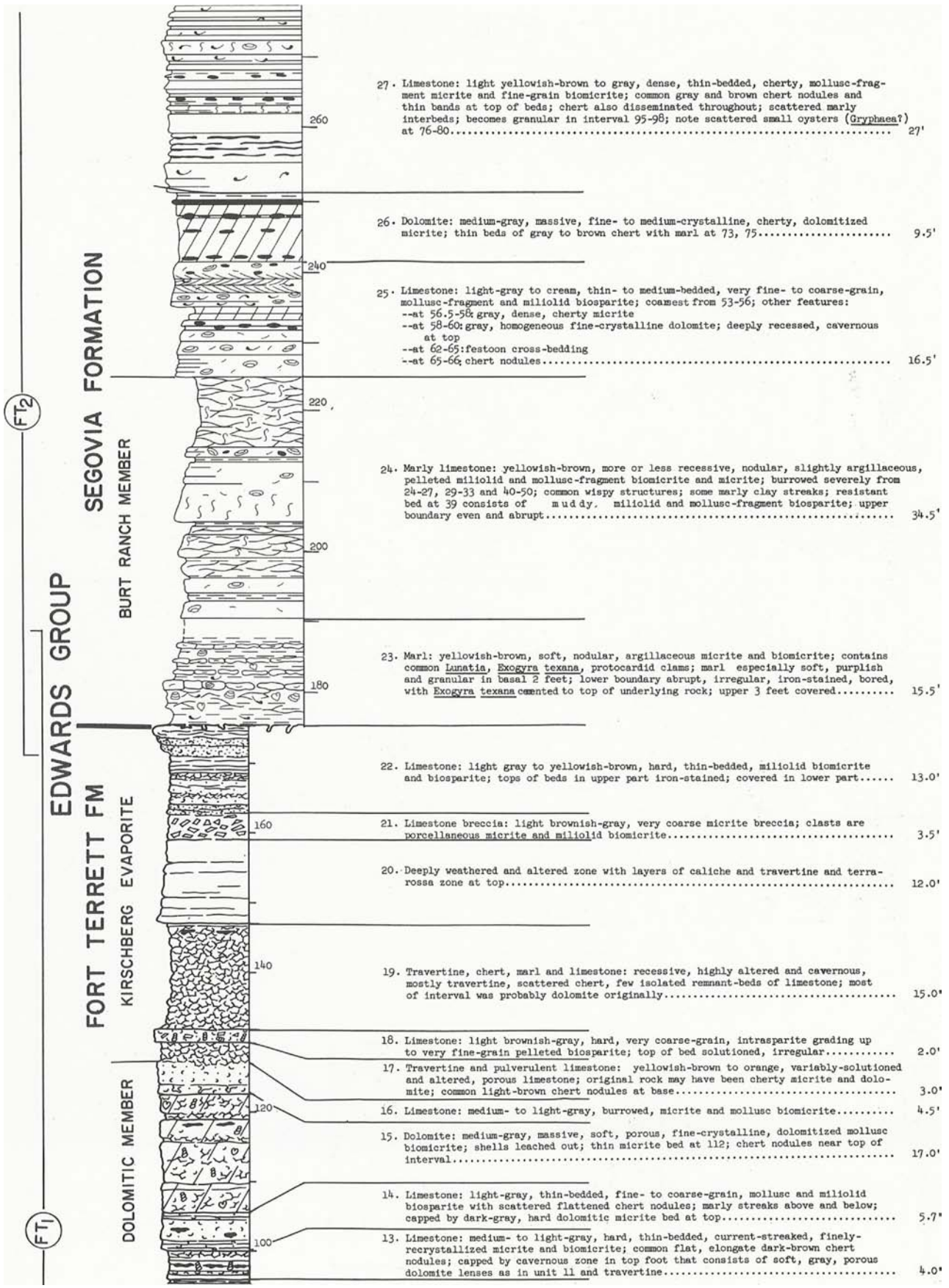




27. Limestone: light yellowish-brown to gray, dense, thin-bedded, cherty, mollusc-fragment micrite and fine-grain biomicrite; common gray and brown chert nodules and thin bands at top of beds; chert also disseminated throughout; scattered marly interbeds; becomes granular in interval 95-98; note scattered small oysters (Gryphaea?) at 76-80..... 27'

26. Dolomite: medium-gray, massive, fine- to medium-crystalline, cherty, dolomitized micrite; thin beds of gray to brown chert with marl at 73, 75..... 9.5'

25. Limestone: light-gray to cream, thin- to medium-bedded, very fine- to coarse-grain, mollusc-fragment and miliolid biosparite; coarsest from 53-56; other features:
--at 56.5-58: gray, dense, cherty micrite
--at 58-60: gray, homogeneous fine-crystalline dolomite; deeply recessed, cavernous at top
--at 62-65: festoon cross-bedding
--at 65-66: chert nodules..... 16.5'

24. Marly limestone: yellowish-brown, more or less recessive, nodular, slightly argillaceous, pelleted miliolid and mollusc-fragment biomicrite and micrite; burrowed severely from 24-27, 29-33 and 40-50; common wispy structures; some marly clay streaks; resistant bed at 39 consists of muddy, miliolid and mollusc-fragment biosparite; upper boundary even and abrupt..... 34.5'

23. Marl: yellowish-brown, soft, nodular, argillaceous micrite and biomicrite; contains common Lunatia, Exogyra texana, protocardid clams; marl especially soft, purplish and granular in basal 2 feet; lower boundary abrupt, irregular, iron-stained, bored, with Exogyra texana cemented to top of underlying rock; upper 3 feet covered..... 15.5'

22. Limestone: light gray to yellowish-brown, hard, thin-bedded, miliolid biomicrite and biosparite; tops of beds in upper part iron-stained; covered in lower part..... 13.0'

21. Limestone breccia: light brownish-gray, very coarse micrite breccia; clasts are porcellaneous micrite and miliolid biomicrite..... 3.5'

20. Deeply weathered and altered zone with layers of caliche and travertine and terra-rossa zone at top..... 12.0'

19. Travertine, chert, marl and limestone: recessive, highly altered and cavernous, mostly travertine, scattered chert, few isolated remnant-beds of limestone; most of interval was probably dolomite originally..... 15.0'

18. Limestone: light brownish-gray, hard, very coarse-grain, intrasparite grading up to very fine-grain pelleted biosparite; top of bed solutioned, irregular..... 2.0'

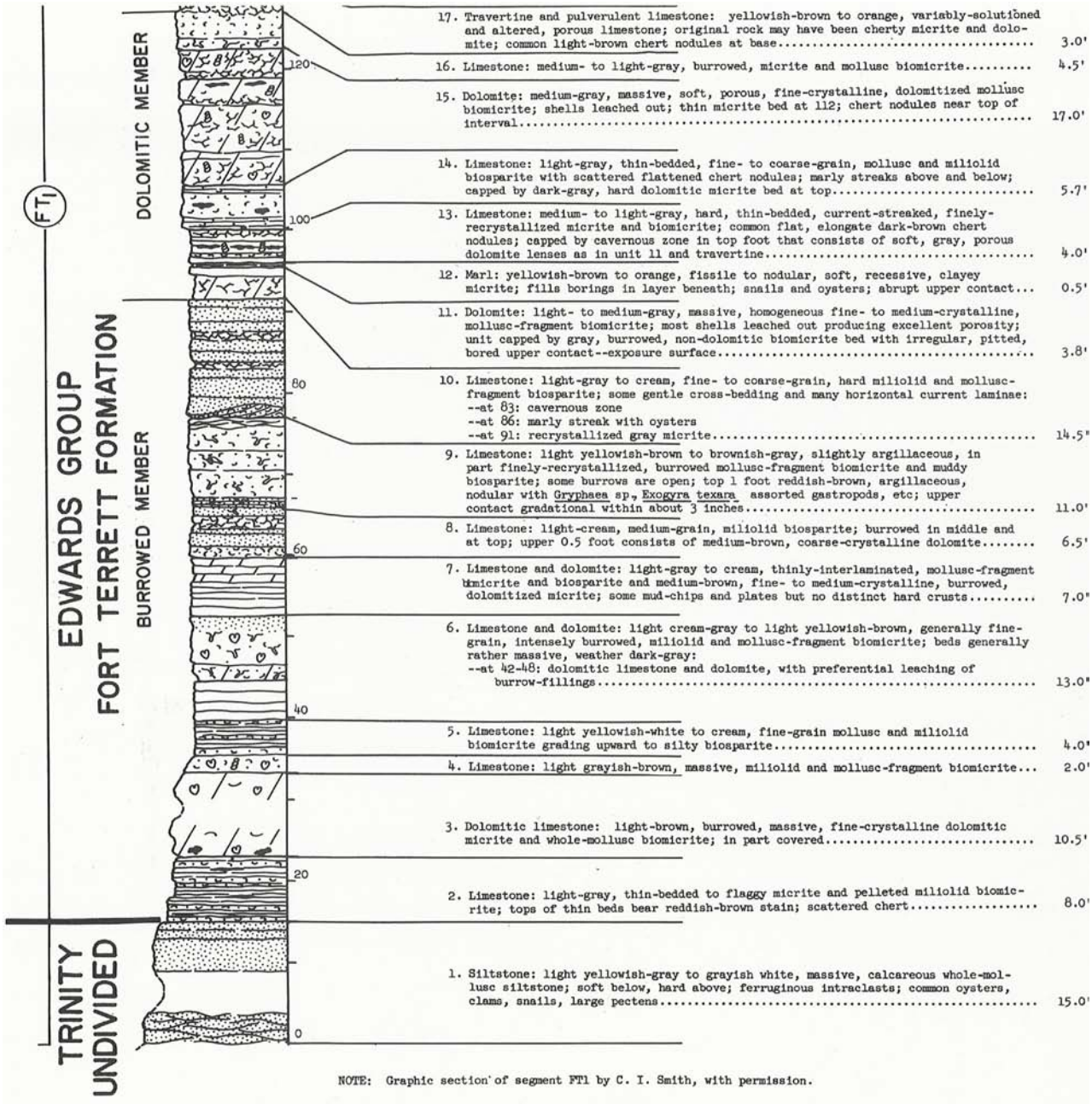
17. Travertine and pulverulent limestone: yellowish-brown to orange, variably-solutioned and altered, porous limestone; original rock may have been cherty micrite and dolomite; common light-brown chert nodules at base..... 3.0'

16. Limestone: medium- to light-gray, burrowed, micrite and mollusc biomicrite..... 4.5'

15. Dolomite: medium-gray, massive, soft, porous, fine-crystalline, dolomitized mollusc biomicrite; shells leached out; thin micrite bed at 112; chert nodules near top of interval..... 17.0'

14. Limestone: light-gray, thin-bedded, fine- to coarse-grain, mollusc and miliolid biosparite with scattered flattened chert nodules; marly streaks above and below; capped by dark-gray, hard dolomitic micrite bed at top..... 5.7'

13. Limestone: medium- to light-gray, hard, thin-bedded, current-streaked, finely-recrystallized micrite and biomicrite; common flat, elongate dark-brown chert nodules; capped by cavernous zone in top foot that consists of soft, gray, porous dolomite lenses as in unit 11 and travertine..... 4.0'



17. Travertine and pulverulent limestone: yellowish-brown to orange, variably-solutioned and altered, porous limestone; original rock may have been cherty micrite and dolomite; common light-brown chert nodules at base..... 3.0'

16. Limestone: medium- to light-gray, burrowed, micrite and mollusc biomicrite..... 4.5'

15. Dolomite: medium-gray, massive, soft, porous, fine-crystalline, dolomitized mollusc biomicrite; shells leached out; thin micrite bed at 112; chert nodules near top of interval..... 17.0'

14. Limestone: light-gray, thin-bedded, fine- to coarse-grain, mollusc and miliolid biosparite with scattered flattened chert nodules; marly streaks above and below; capped by dark-gray, hard dolomitic micrite bed at top..... 5.7'

13. Limestone: medium- to light-gray, hard, thin-bedded, current-streaked, finely-recrystallized micrite and biomicrite; common flat, elongate dark-brown chert nodules; capped by cavernous zone in top foot that consists of soft, gray, porous dolomite lenses as in unit 11 and travertine..... 4.0'

12. Marl: yellowish-brown to orange, fissile to nodular, soft, recessive, clayey micrite; fills borings in layer beneath; snails and oysters; abrupt upper contact... 0.5'

11. Dolomite: light- to medium-gray, massive, homogeneous fine- to medium-crystalline, mollusc-fragment biomicrite; most shells leached out producing excellent porosity; unit capped by gray, burrowed, non-dolomitic biomicrite bed with irregular, pitted, bored upper contact--exposure surface..... 3.8'

10. Limestone: light-gray to cream, fine- to coarse-grain, hard miliolid and mollusc-fragment biosparite; some gentle cross-bedding and many horizontal current laminae:
--at 83: cavernous zone
--at 86: marly streak with oysters
--at 91: recrystallized gray micrite..... 14.5'

9. Limestone: light yellowish-brown to brownish-gray, slightly argillaceous, in part finely-recrystallized, burrowed mollusc-fragment biomicrite and muddy biosparite; some burrows are open; top 1 foot reddish-brown, argillaceous, nodular with *Gryphaea* sp., *Exogyra texana* assorted gastropods, etc; upper contact gradational within about 3 inches..... 11.0'

8. Limestone: light-cream, medium-grain, miliolid biosparite; burrowed in middle and at top; upper 0.5 foot consists of medium-brown, coarse-crystalline dolomite..... 6.5'

7. Limestone and dolomite: light-gray to cream, thinly-interlaminated, mollusc-fragment biomicrite and biosparite and medium-brown, fine- to medium-crystalline, burrowed, dolomitized micrite; some mud-chips and plates but no distinct hard crusts..... 7.0'

6. Limestone and dolomite: light cream-gray to light yellowish-brown, generally fine-grain, intensely burrowed, miliolid and mollusc-fragment biomicrite; beds generally rather massive, weather dark-gray:
--at 42-48: dolomitic limestone and dolomite, with preferential leaching of burrow-fillings..... 13.0'

5. Limestone: light yellowish-white to cream, fine-grain mollusc and miliolid biomicrite grading upward to silty biosparite..... 4.0'

4. Limestone: light grayish-brown, massive, miliolid and mollusc-fragment biomicrite... 2.0'

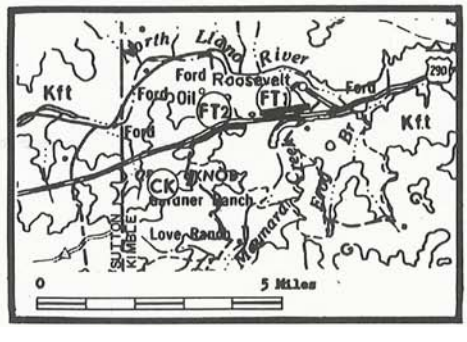
3. Dolomitic limestone: light-brown, burrowed, massive, fine-crystalline dolomitic micrite and whole-mollusc biomicrite; in part covered..... 10.5'

2. Limestone: light-gray, thin-bedded to flaggy micrite and pelleted miliolid biomicrite; tops of thin beds bear reddish-brown stain; scattered chert..... 8.0'

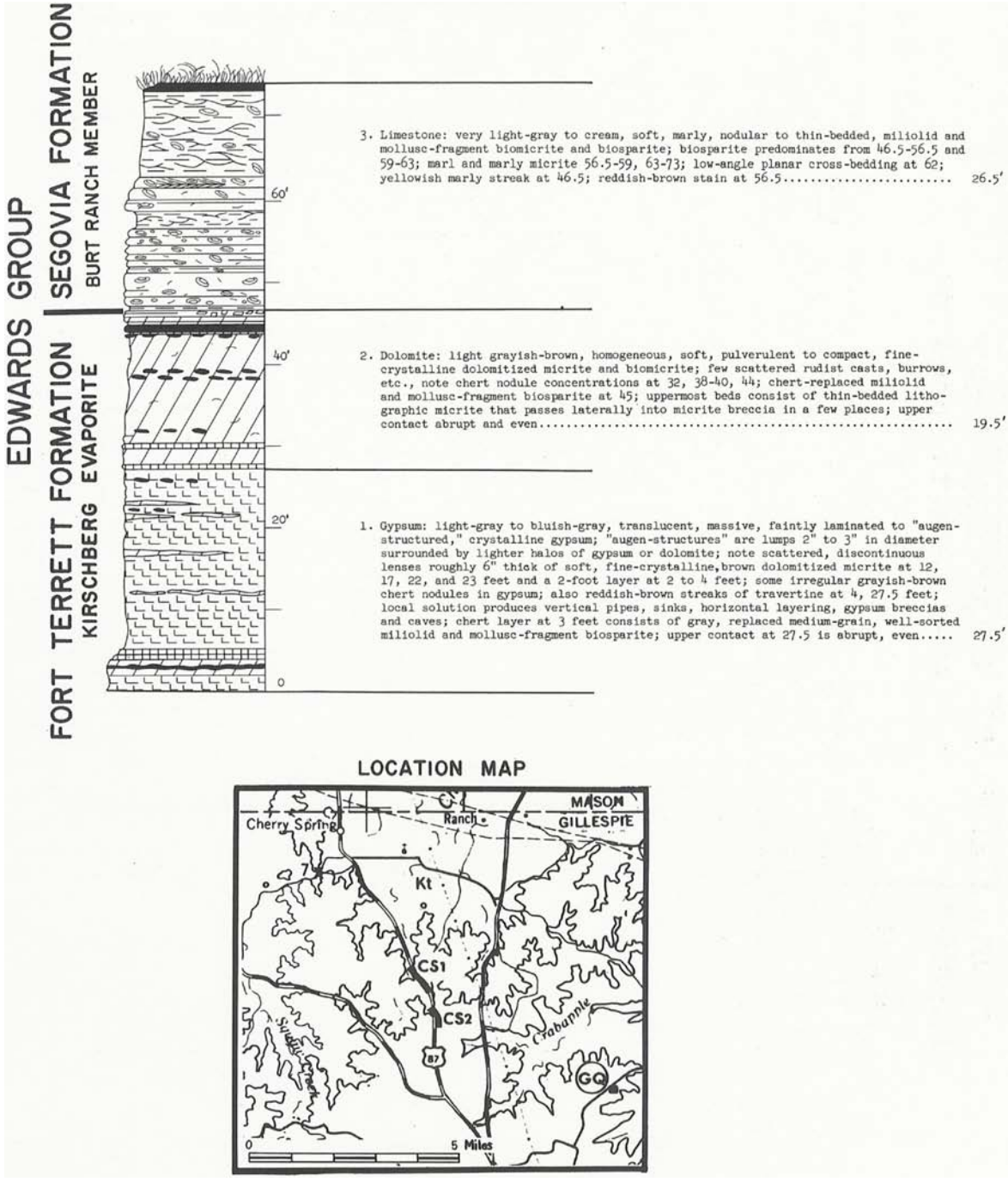
1. Siltstone: light yellowish-gray to grayish white, massive, calcareous whole-mollusc siltstone; soft below, hard above; ferruginous intraclasts; common oysters, clams, snails, large pectens..... 15.0'

NOTE: Graphic section of segment FT1 by C. I. Smith, with permission.

LOCATION MAP

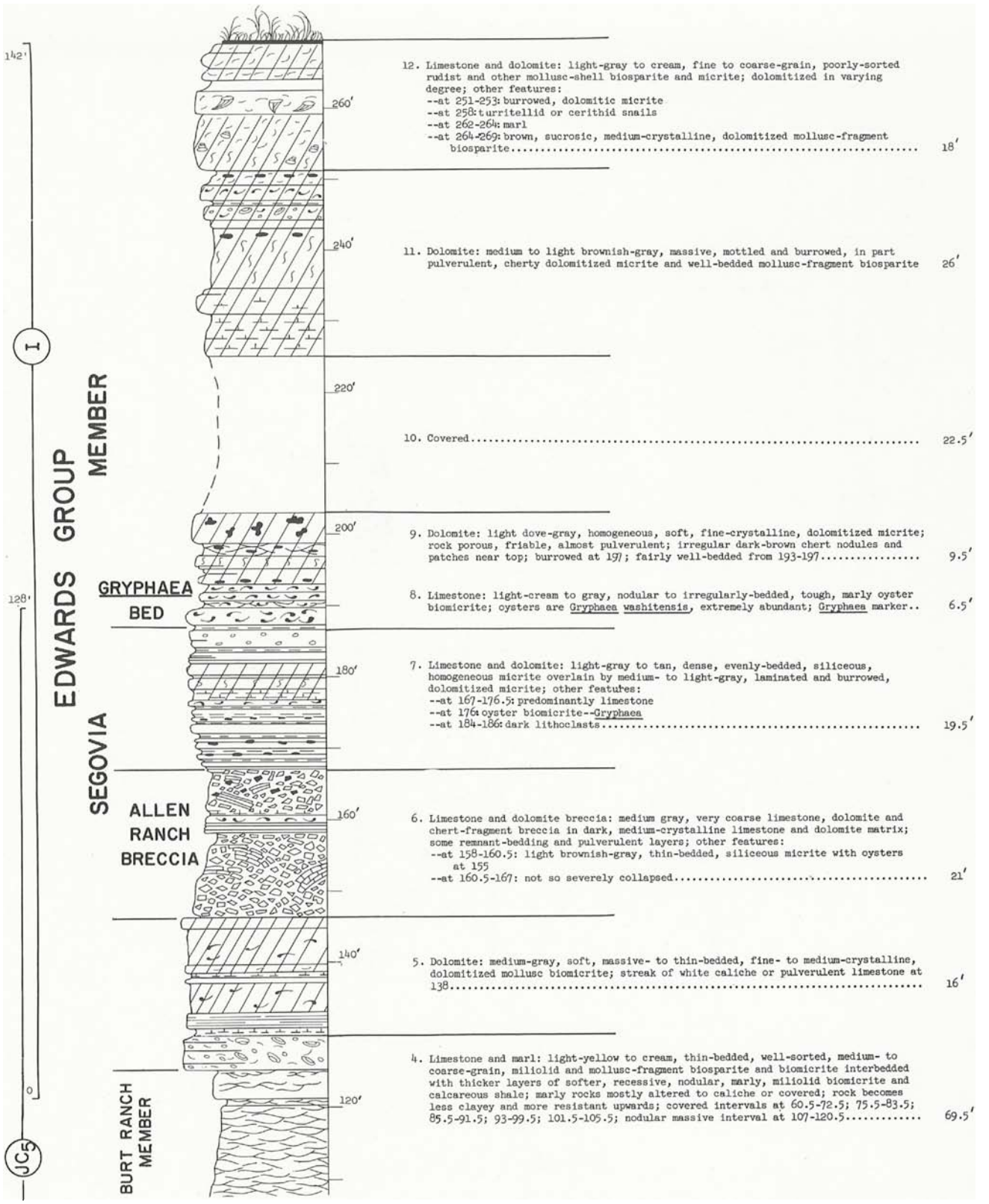


GYPSUM QUARRY



LOCATION MAP

JOY CREEK COMPOSITE



12. Limestone and dolomite: light-gray to cream, fine to coarse-grain, poorly-sorted rudist and other mollusc-shell biosparite and micrite; dolomitized in varying degree; other features:
--at 251-253: burrowed, dolomitic micrite
--at 258: turritellid or cerithid snails
--at 262-264: marl
--at 264-269: brown, sucrosic, medium-crystalline, dolomitized mollusc-fragment biosparite..... 18'

11. Dolomite: medium to light brownish-gray, massive, mottled and burrowed, in part pulverulent, cherty dolomitized micrite and well-bedded mollusc-fragment biosparite 26'

10. Covered..... 22.5'

9. Dolomite: light dove-gray, homogeneous, soft, fine-crystalline, dolomitized micrite; rock porous, friable, almost pulverulent; irregular dark-brown chert nodules and patches near top; burrowed at 197; fairly well-bedded from 193-197..... 9.5'

8. Limestone: light-cream to gray, nodular to irregularly-bedded, tough, marly oyster biomicrite; oysters are Gryphaea washitensis, extremely abundant; Gryphaea marker.. 6.5'

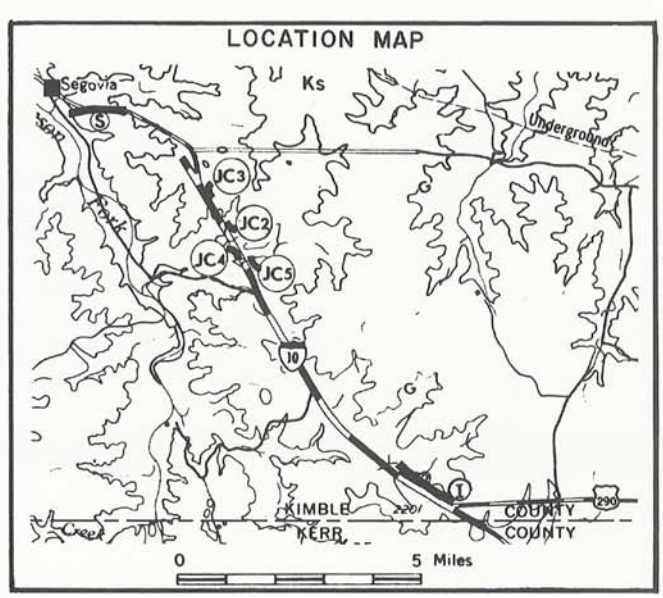
7. Limestone and dolomite: light-gray to tan, dense, evenly-bedded, siliceous, homogeneous micrite overlain by medium- to light-gray, laminated and burrowed, dolomitized micrite; other features:
--at 167-176.5: predominantly limestone
--at 176: oyster biomicrite--Gryphaea
--at 184-186: dark lithoclasts..... 19.5'

6. Limestone and dolomite breccia: medium gray, very coarse limestone, dolomite and chert-fragment breccia in dark, medium-crystalline limestone and dolomite matrix; some remnant-bedding and pulverulent layers; other features:
--at 158-160.5: light brownish-gray, thin-bedded, siliceous micrite with oysters at 155
--at 160.5-167: not so severely collapsed..... 21'

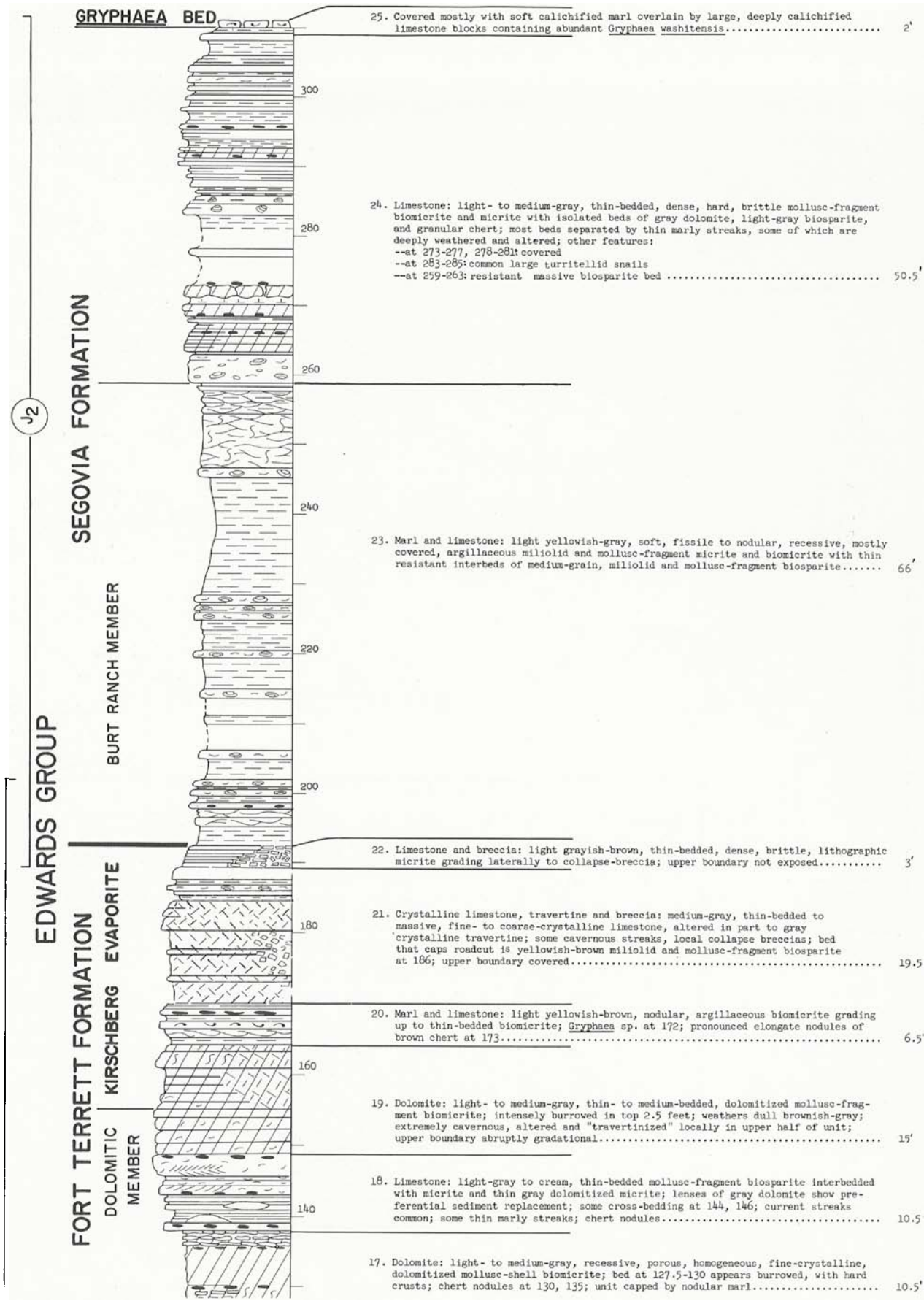
5. Dolomite: medium-gray, soft, massive- to thin-bedded, fine- to medium-crystalline, dolomitized mollusc biomicrite; streak of white caliche or pulverulent limestone at 138..... 16'

4. Limestone and marl: light-yellow to cream, thin-bedded, well-sorted, medium- to coarse-grain, miliolid and mollusc-fragment biosparite and biomicrite interbedded with thicker layers of softer, recessive, nodular, marly, miliolid biomicrite and calcareous shale; marly rocks mostly altered to caliche or covered; rock becomes less clayey and more resistant upwards; covered intervals at 60.5-72.5; 75.5-83.5; 85.5-91.5; 93-99.5; 101.5-105.5; nodular massive interval at 107-120.5..... 69.5'

JC5
JC4
EDWARDS GROUP
SEGOVIA MEMBER
BURT RANCH MEMBER
FORT TERRETT FORMATION
KIRSCHBERG EVAPORITE
100'
80'
60'
40'
20'
0'
60
0
3. Limestone breccia: light grayish-brown, hard, brittle, porous, very coarse-grain, chaotic micrite collapse breccia; light-gray to olive-gray thin-bedded micrite at 58-60.5 merges downwards with breccia..... 16'
2. Crystalline limestone and dolomite: medium-gray to light grayish-brown, medium- to coarse-crystalline, thinly-layered to massive, solutioned, cavernous and "travertinized" limestone with interlayered fine- to medium-crystalline, thin-bedded to massive, porous dolomitized biomicrite and micrite; common brown and gray chert nodules; other features as noted:
--at 2-7, 11.5-19.5: covered earth slope
--at 19.5-22.5, 27-29, 44: pulverulent in part
--at 29-30: cream, medium-grain, pelecypod biosparite..... 43.5'
1. Limestone: light yellowish-gray to cream, poorly-sorted, porous, evenly-bedded, mollusc-fragment biomicrite; forms pavement in creek bed..... 2'


LOCATION MAP
Segovia
Ks
Undergrounds
JC3
JC2
JC4
JC5
10
KIMBLE
COUNTY
KERR
COUNTY
0
5 Miles

JUNCTION COMPOSITE



25. Covered mostly with soft calichified marl overlain by large, deeply calichified limestone blocks containing abundant Gryphaea washitensis..... 2'

24. Limestone: light- to medium-gray, thin-bedded, dense, hard, brittle mollusc-fragment biomicrite and micrite with isolated beds of gray dolomite, light-gray biosparite, and granular chert; most beds separated by thin marly streaks, some of which are deeply weathered and altered; other features:
--at 273-277, 278-281: covered
--at 283-285: common large turritellid snails
--at 259-263: resistant massive biosparite bed ..... 50.5'

23. Marl and limestone: light yellowish-gray, soft, fissile to nodular, recessive, mostly covered, argillaceous miliolid and mollusc-fragment micrite and biomicrite with thin resistant interbeds of medium-grain, miliolid and mollusc-fragment biosparite..... 66'

22. Limestone and breccia: light grayish-brown, thin-bedded, dense, brittle, lithographic micrite grading laterally to collapse-breccia; upper boundary not exposed..... 3'

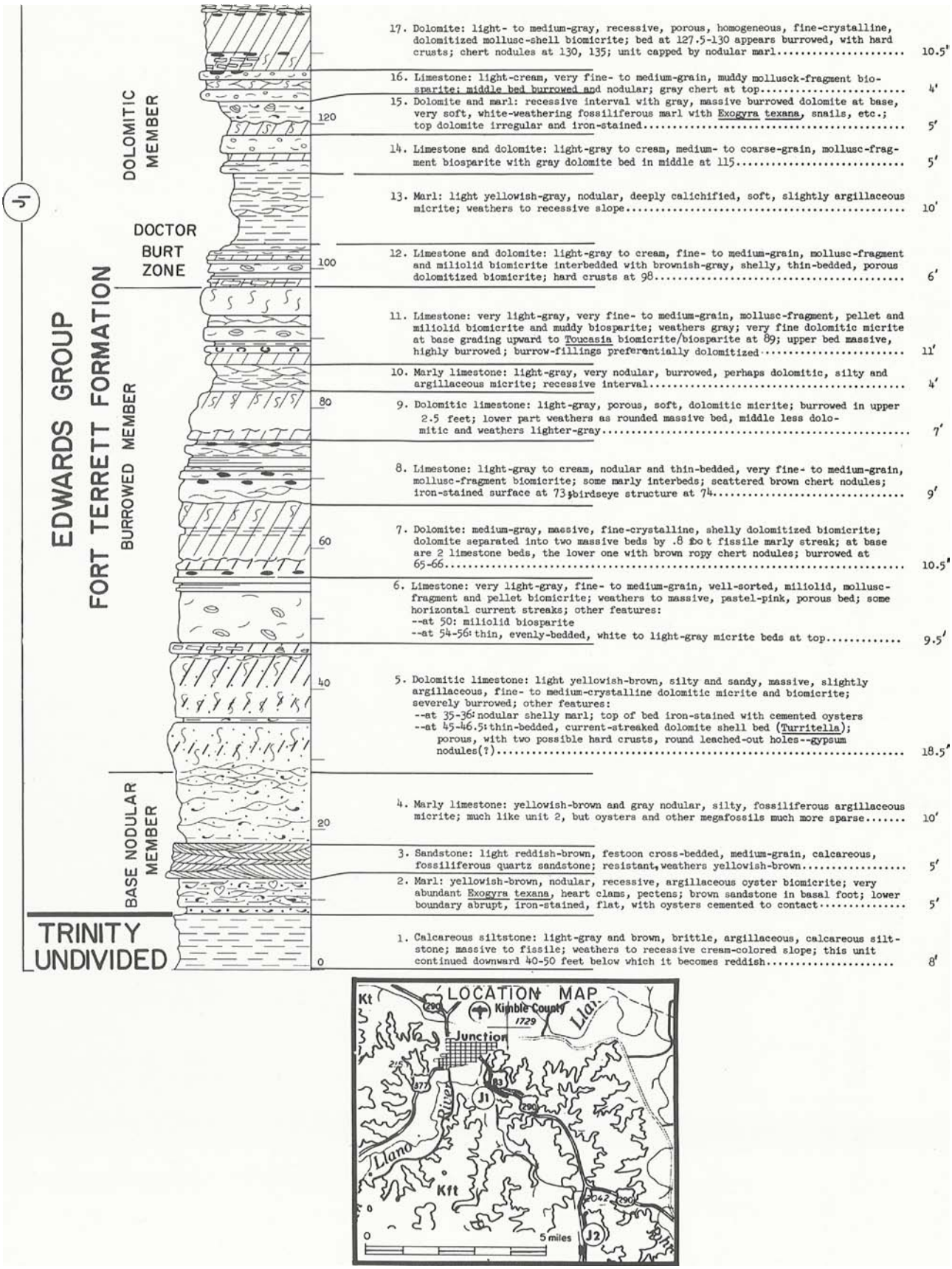
21. Crystalline limestone, travertine and breccia: medium-gray, thin-bedded to massive, fine- to coarse-crystalline limestone, altered in part to gray crystalline travertine; some cavernous streaks, local collapse breccias; bed that caps roadcut is yellowish-brown miliolid and mollusc-fragment biosparite at 186; upper boundary covered..... 19.5'

20. Marl and limestone: light yellowish-brown, nodular, argillaceous biomicrite grading up to thin-bedded biomicrite; Gryphaea sp. at 172; pronounced elongate nodules of brown chert at 173..... 6.5'

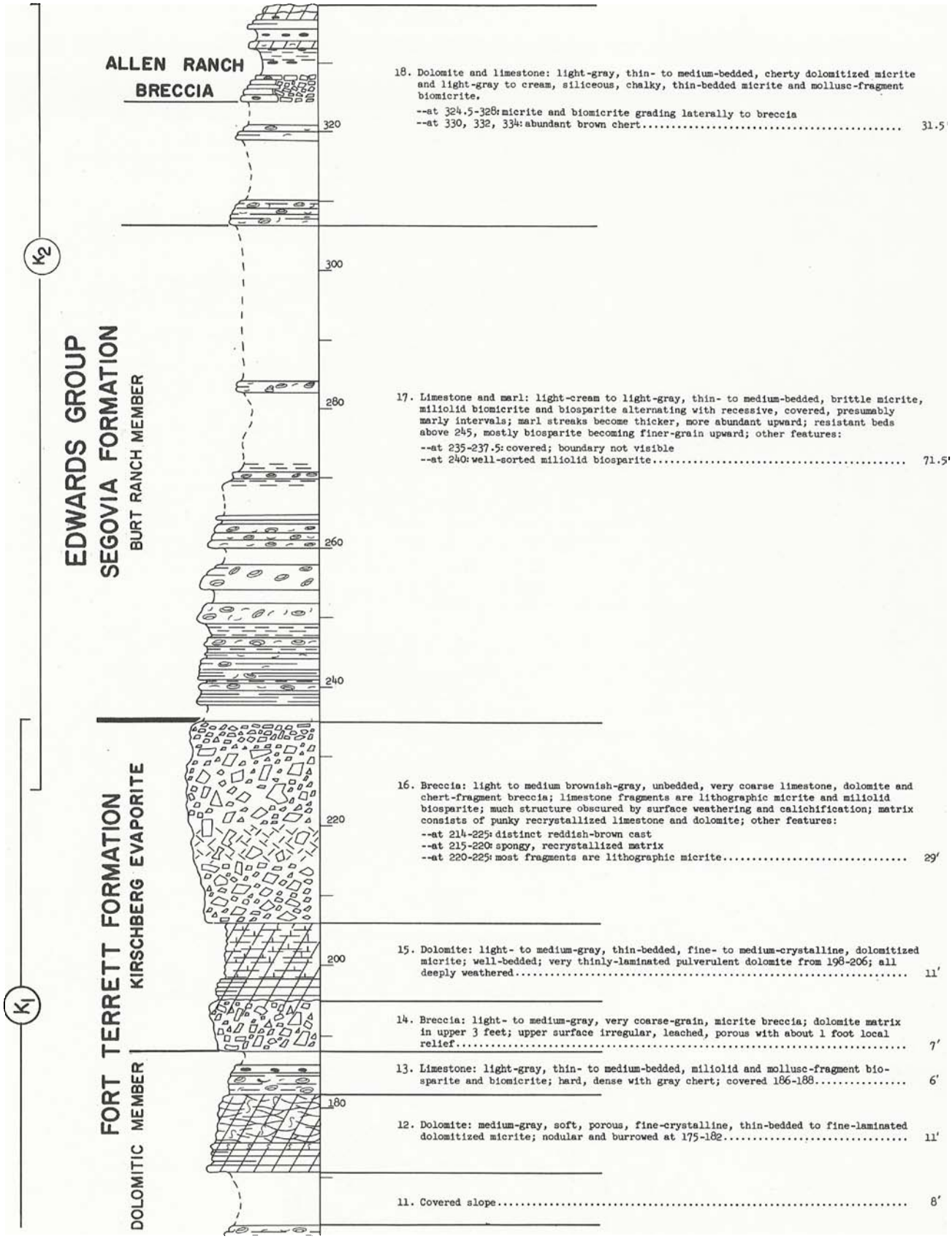
19. Dolomite: light- to medium-gray, thin- to medium-bedded, dolomitized mollusc-fragment biomicrite; intensely burrowed in top 2.5 feet; weathers dull brownish-gray; extremely cavernous, altered and "travertinized" locally in upper half of unit; upper boundary abruptly gradational..... 15'

18. Limestone: light-gray to cream, thin-bedded mollusc-fragment biosparite interbedded with micrite and thin gray dolomitized micrite; lenses of gray dolomite show preferential sediment replacement; some cross-bedding at 144, 146; current streaks common; some thin marly streaks; chert nodules..... 10.5'

17. Dolomite: light- to medium-gray, recessive, porous, homogeneous, fine-crystalline, dolomitized mollusc-shell biomicrite; bed at 127.5-130 appears burrowed, with hard crusts; chert nodules at 130, 135; unit capped by nodular marl..... 10.5'


J1
EDWARDS GROUP
FORT TERRETT FORMATION
DOLOMITIC MEMBER
DOCTOR BURT ZONE
BURROWED MEMBER
BASE NODULAR MEMBER
TRINITY UNDIVIDED
120
100
80
60
40
20
0
17. Dolomite: light- to medium-gray, recessive, porous, homogeneous, fine-crystalline, dolomitized mollusc-shell biomicrite; bed at 127.5-130 appears burrowed, with hard crusts; chert nodules at 130, 135; unit capped by nodular marl..... 10.5'
16. Limestone: light-cream, very fine- to medium-grain, muddy mollusck-fragment biosparite; middle bed burrowed and nodular; gray chert at top..... 4'
15. Dolomite and marl: recessive interval with gray, massive burrowed dolomite at base, very soft, white-weathering fossiliferous marl with Exogyra texana, snails, etc.; top dolomite irregular and iron-stained..... 5'
14. Limestone and dolomite: light-gray to cream, medium- to coarse-grain, mollusc-fragment biosparite with gray dolomite bed in middle at 115..... 5'
13. Marl: light yellowish-gray, nodular, deeply calichified, soft, slightly argillaceous micrite; weathers to recessive slope..... 10'
12. Limestone and dolomite: light-gray to cream, fine- to medium-grain, mollusc-fragment and miliolid biomicrite interbedded with brownish-gray, shelly, thin-bedded, porous dolomitized biomicrite; hard crusts at 98..... 6'
11. Limestone: very light-gray, very fine- to medium-grain, mollusc-fragment, pellet and miliolid biomicrite and muddy biosparite; weathers gray; very fine dolomitic micrite at base grading upward to Toucasia biomicrite/biosparite at 89; upper bed massive, highly burrowed; burrow-fillings preferentially dolomitized..... 11'
10. Marly limestone: light-gray, very nodular, burrowed, perhaps dolomitic, silty and argillaceous micrite; recessive interval..... 4'
9. Dolomitic limestone: light-gray, porous, soft, dolomitic micrite; burrowed in upper 2.5 feet; lower part weathers as rounded massive bed, middle less dolomitic and weathers lighter-gray..... 7'
8. Limestone: light-gray to cream, nodular and thin-bedded, very fine- to medium-grain, mollusc-fragment biomicrite; some marly interbeds; scattered brown chert nodules; iron-stained surface at 73; birdseye structure at 74..... 9'
7. Dolomite: medium-gray, massive, fine-crystalline, shelly dolomitized biomicrite; dolomite separated into two massive beds by .8 foot fissile marly streak; at base are 2 limestone beds, the lower one with brown ropy chert nodules; burrowed at 65-66..... 10.5'
6. Limestone: very light-gray, fine- to medium-grain, well-sorted, miliolid, mollusc-fragment and pellet biomicrite; weathers to massive, pastel-pink, porous bed; some horizontal current streaks; other features:
--at 50: miliolid biosparite
--at 54-56: thin, evenly-bedded, white to light-gray micrite beds at top..... 9.5'
5. Dolomitic limestone: light yellowish-brown, silty and sandy, massive, slightly argillaceous, fine- to medium-crystalline dolomitic micrite and biomicrite; severely burrowed; other features:
--at 35-36: nodular shelly marl; top of bed iron-stained with cemented oysters
--at 45-46.5: thin-bedded, current-streaked dolomite shell bed (Turritella); porous, with two possible hard crusts, round leached-out holes--gypsum nodules(?)..... 18.5'
4. Marly limestone: yellowish-brown and gray nodular, silty, fossiliferous argillaceous micrite; much like unit 2, but oysters and other megafossils much more sparse..... 10'
3. Sandstone: light reddish-brown, festoon cross-bedded, medium-grain, calcareous, fossiliferous quartz sandstone; resistant, weathers yellowish-brown..... 5'
2. Marl: yellowish-brown, nodular, recessive, argillaceous oyster biomicrite; very abundant Exogyra texana, heart clams, pectens; brown sandstone in basal foot; lower boundary abrupt, iron-stained, flat, with oysters cemented to contact..... 5'
1. Calcareous siltstone: light-gray and brown, brittle, argillaceous, calcareous siltstone; massive to fissile; weathers to recessive cream-colored slope; this unit continued downward 40-50 feet below which it becomes reddish..... 8'
LOCATION MAP
Kt
290
Kimble County
1729
Llan.
Junction
377
83
J1
290
River
Llano
Klt
2042
290
0
5 miles
J2

KERRVILLE



18. Dolomite and limestone: light-gray, thin- to medium-bedded, cherty dolomitized micrite and light-gray to cream, siliceous, chalky, thin-bedded micrite and mollusc-fragment biomicrite.
    --at 324.5-328: micrite and biomicrite grading laterally to breccia
    --at 330, 332, 334: abundant brown chert..... 31.5'

17. Limestone and marl: light-cream to light-gray, thin- to medium-bedded, brittle micrite, miliolid biomicrite and biosparite alternating with recessive, covered, presumably marly intervals; marl streaks become thicker, more abundant upward; resistant beds above 245, mostly biosparite becoming finer-grain upward; other features:
    --at 235-237.5: covered; boundary not visible
    --at 240: well-sorted miliolid biosparite..... 71.5'

16. Breccia: light to medium brownish-gray, unbedded, very coarse limestone, dolomite and chert-fragment breccia; limestone fragments are lithographic micrite and miliolid biosparite; much structure obscured by surface weathering and calichification; matrix consists of punky recrystallized limestone and dolomite; other features:
    --at 214-225: distinct reddish-brown cast
    --at 215-220: spongy, recrystallized matrix
    --at 220-225: most fragments are lithographic micrite..... 29'

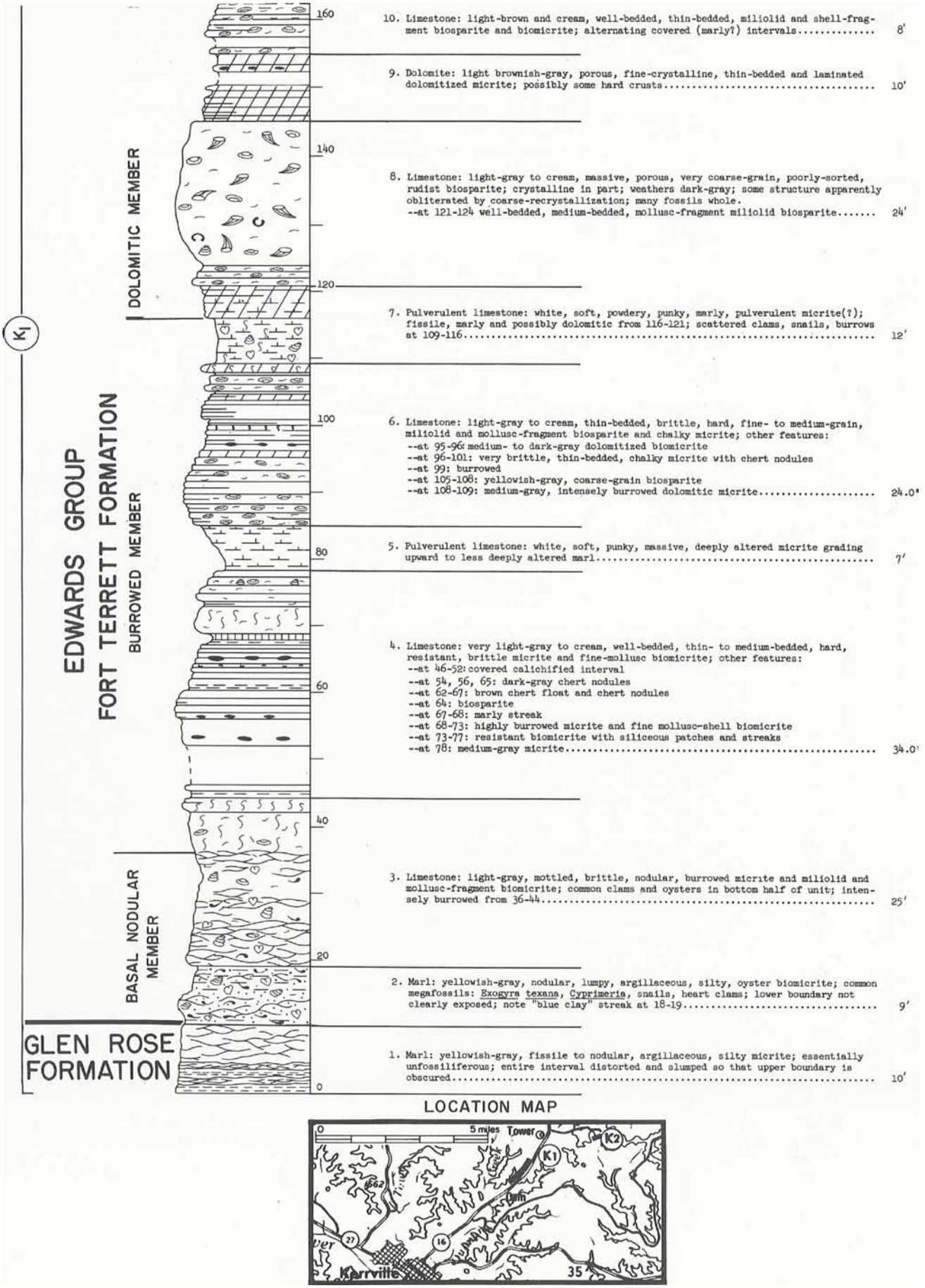
15. Dolomite: light- to medium-gray, thin-bedded, fine- to medium-crystalline, dolomitized micrite; well-bedded; very thinly-laminated pulverulent dolomite from 198-206; all deeply weathered..... 11'

14. Breccia: light- to medium-gray, very coarse-grain, micrite breccia; dolomite matrix in upper 3 feet; upper surface irregular, leached, porous with about 1 foot local relief..... 7'

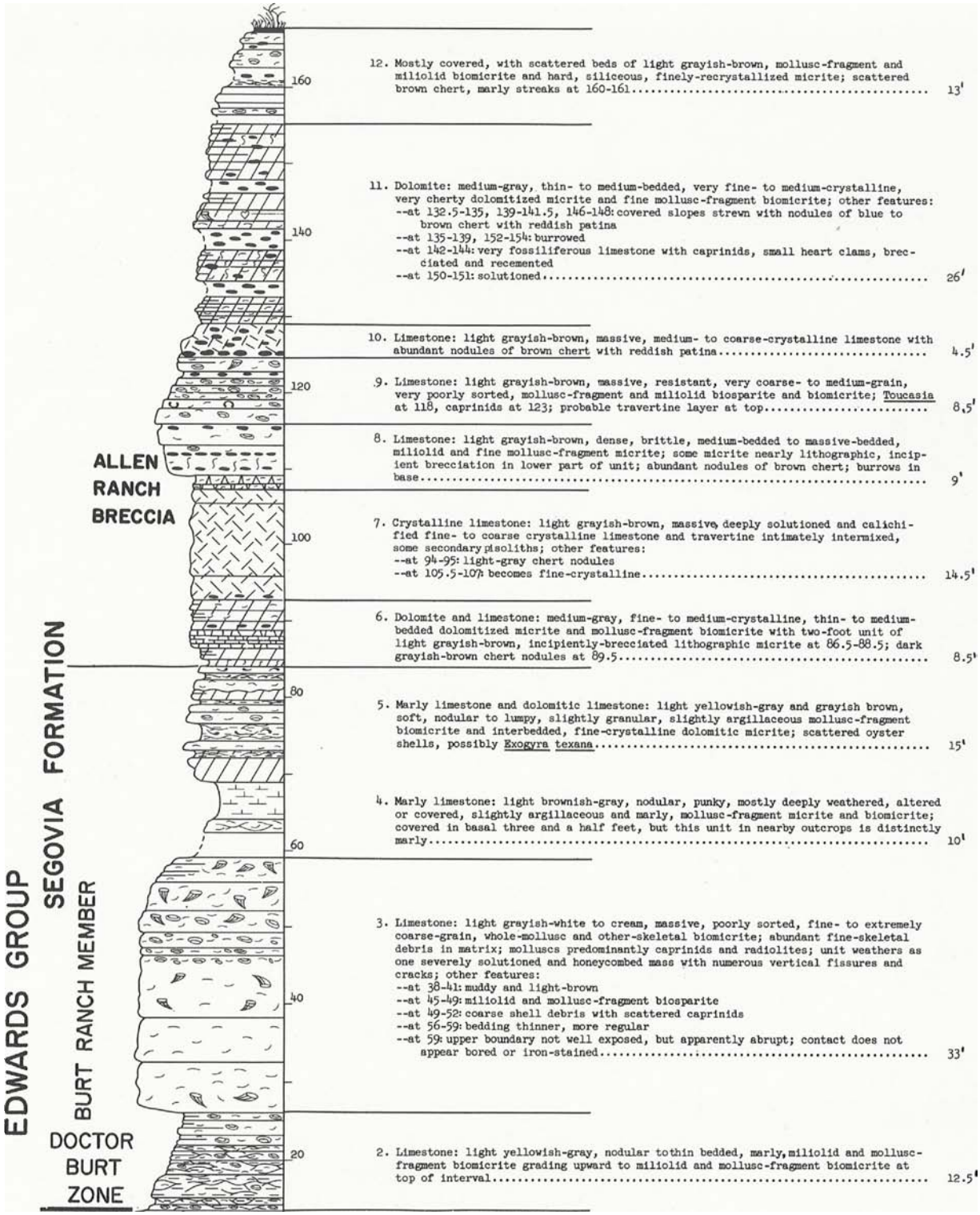
13. Limestone: light-gray, thin- to medium-bedded, miliolid and mollusc-fragment biosparite and biomicrite; hard, dense with gray chert; covered 186-188..... 6'

12. Dolomite: medium-gray, soft, porous, fine-crystalline, thin-bedded to fine-laminated dolomitized micrite; nodular and burrowed at 175-182..... 11'

11. Covered slope..... 8'


EDWARDS GROUP
FORT TERRETT FORMATION
DOLOMITIC MEMBER
BURROWED MEMBER
BASAL NODULAR MEMBER
GLEN ROSE FORMATION
K1
160
140
120
100
80
60
40
20
0
10. Limestone: light-brown and cream, well-bedded, thin-bedded, miliolid and shell-fragment biosparite and biomicrite; alternating covered (marly?) intervals..... 8'
9. Dolomite: light brownish-gray, porous, fine-crystalline, thin-bedded and laminated dolomitized micrite; possibly some hard crusts..... 10'
8. Limestone: light-gray to cream, massive, porous, very coarse-grain, poorly-sorted, rudist biosparite; crystalline in part; weathers dark-gray; some structure apparently obliterated by coarse-recrystallization; many fossils whole.
--at 121-124 well-bedded, medium-bedded, mollusc-fragment miliolid biosparite..... 24'
7. Pulverulent limestone: white, soft, powdery, punky, marly, pulverulent micrite(?); fissile, marly and possibly dolomitic from 116-121; scattered clams, snails, burrows at 109-116..... 12'
6. Limestone: light-gray to cream, thin-bedded, brittle, hard, fine- to medium-grain, miliolid and mollusc-fragment biosparite and chalky micrite; other features:
--at 95-96: medium- to dark-gray dolomitized biomicrite
--at 96-101: very brittle, thin-bedded, chalky micrite with chert nodules
--at 99: burrowed
--at 105-108: yellowish-gray, coarse-grain biosparite
--at 108-109: medium-gray, intensely burrowed dolomitic micrite..... 24.0'
5. Pulverulent limestone: white, soft, punky, massive, deeply altered micrite grading upward to less deeply altered marl..... 7'
4. Limestone: very light-gray to cream, well-bedded, thin- to medium-bedded, hard, resistant, brittle micrite and fine-mollusc biomicrite; other features:
--at 46-52: covered calichified interval
--at 54, 56, 65: dark-gray chert nodules
--at 62-67: brown chert float and chert nodules
--at 64: biosparite
--at 67-68: marly streak
--at 68-73: highly burrowed micrite and fine mollusc-shell biomicrite
--at 73-77: resistant biomicrite with siliceous patches and streaks
--at 78: medium-gray micrite..... 34.0'
3. Limestone: light-gray, mottled, brittle, nodular, burrowed micrite and miliolid and mollusc-fragment biomicrite; common clams and oysters in bottom half of unit; intensely burrowed from 36-44..... 25'
2. Marl: yellowish-gray, nodular, lumpy, argillaceous, silty, oyster biomicrite; common megafossils: Exogyra texana, Cyprimeria, snails, heart clams; lower boundary not clearly exposed; note "blue clay" streak at 18-19..... 9'
1. Marl: yellowish-gray, fissile to nodular, argillaceous, silty micrite; essentially unfossiliferous; entire interval distorted and slumped so that upper boundary is obscured..... 10'
LOCATION MAP
0
5 miles
Tower
K1
K2
Creek
Elm
Karnes
35

LOUIS REAL



12. Mostly covered, with scattered beds of light grayish-brown, mollusc-fragment and miliolid biomicrite and hard, siliceous, finely-recrystallized micrite; scattered brown chert, marly streaks at 160-161..... 13'

11. Dolomite: medium-gray, thin- to medium-bedded, very fine- to medium-crystalline, very cherty dolomitized micrite and fine mollusc-fragment biomicrite; other features:
--at 132.5-135, 139-141.5, 146-148: covered slopes strewn with nodules of blue to brown chert with reddish patina
--at 135-139, 152-154: burrowed
--at 142-144: very fossiliferous limestone with caprinids, small heart clams, brecciated and recemented
--at 150-151: solutioned..... 26'

10. Limestone: light grayish-brown, massive, medium- to coarse-crystalline limestone with abundant nodules of brown chert with reddish patina..... 4.5'

9. Limestone: light grayish-brown, massive, resistant, very coarse- to medium-grain, very poorly sorted, mollusc-fragment and miliolid biosparite and biomicrite; Toucasia at 118, caprinids at 123; probable travertine layer at top..... 8.5'

8. Limestone: light grayish-brown, dense, brittle, medium-bedded to massive-bedded, miliolid and fine mollusc-fragment micrite; some micrite nearly lithographic, incipient brecciation in lower part of unit; abundant nodules of brown chert; burrows in base..... 9'

7. Crystalline limestone: light grayish-brown, massive, deeply solutioned and calichified fine- to coarse crystalline limestone and travertine intimately intermixed, some secondary pisoliths; other features:
--at 94-95: light-gray chert nodules
--at 105.5-107: becomes fine-crystalline..... 14.5'

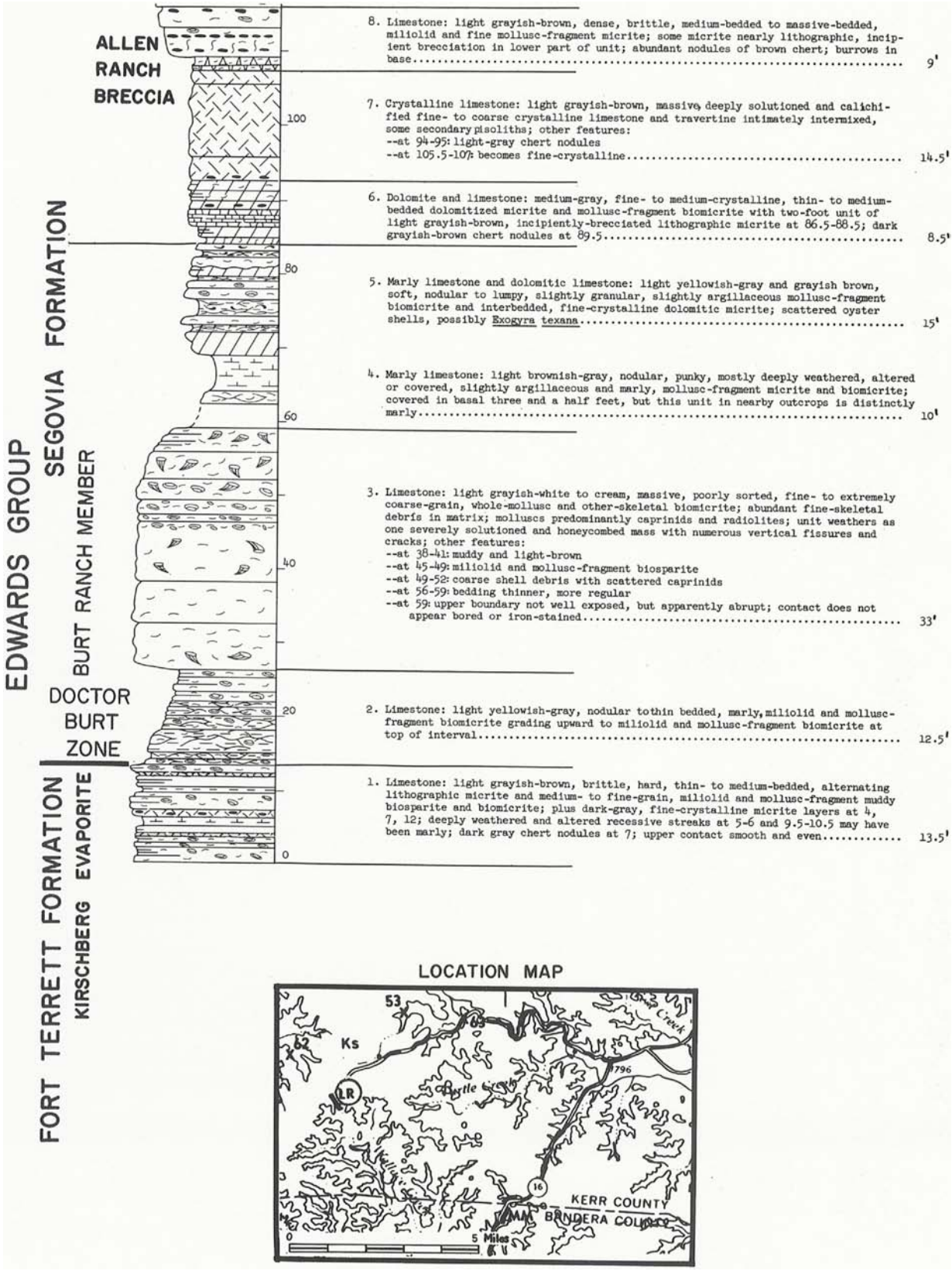
6. Dolomite and limestone: medium-gray, fine- to medium-crystalline, thin- to medium-bedded dolomitized micrite and mollusc-fragment biomicrite with two-foot unit of light grayish-brown, incipiently-brecciated lithographic micrite at 86.5-88.5; dark grayish-brown chert nodules at 89.5..... 8.5'

5. Marly limestone and dolomitic limestone: light yellowish-gray and grayish brown, soft, nodular to lumpy, slightly granular, slightly argillaceous mollusc-fragment biomicrite and interbedded, fine-crystalline dolomitic micrite; scattered oyster shells, possibly Exogyra texana..... 15'

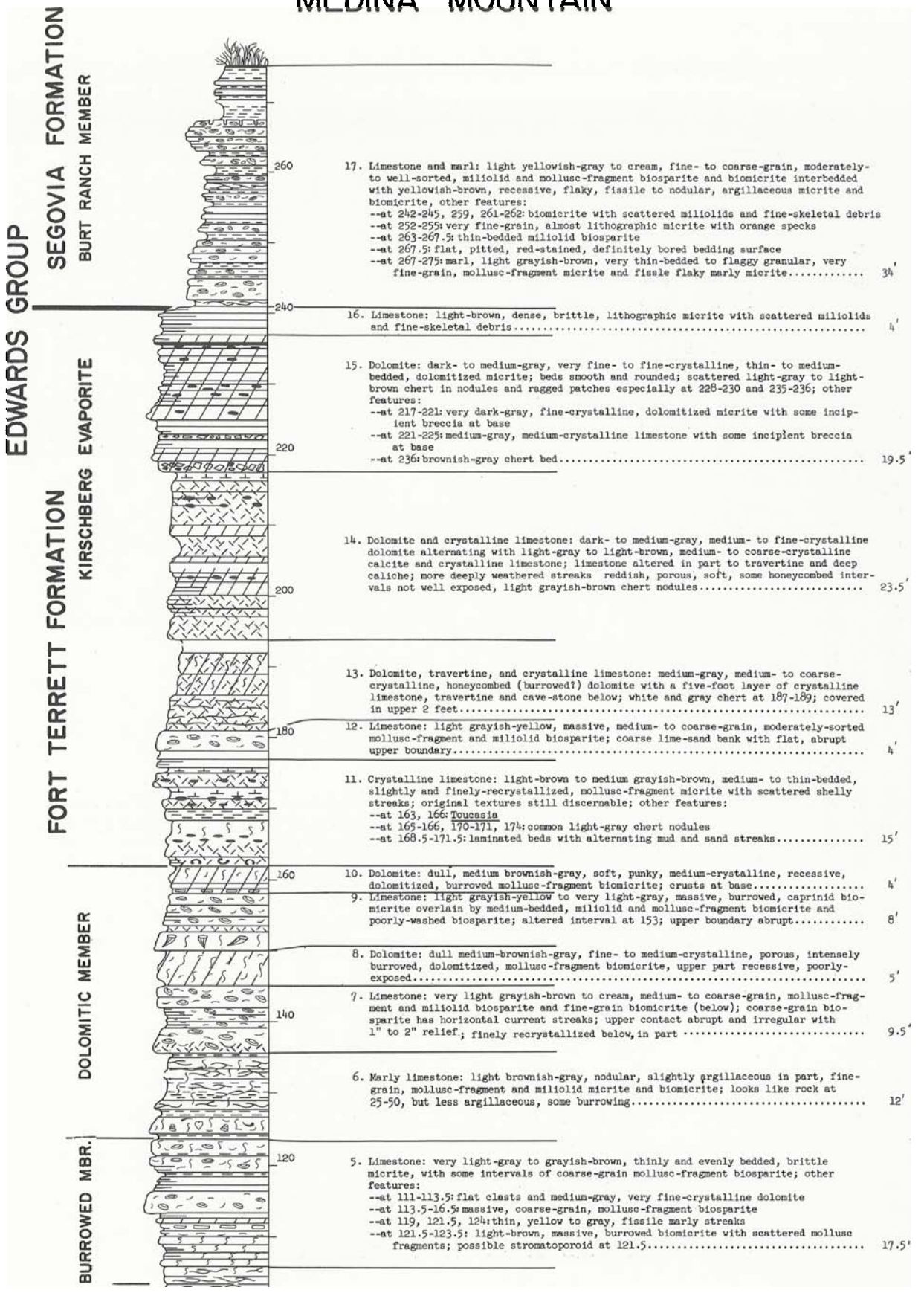
4. Marly limestone: light brownish-gray, nodular, punky, mostly deeply weathered, altered or covered, slightly argillaceous and marly, mollusc-fragment micrite and biomicrite; covered in basal three and a half feet, but this unit in nearby outcrops is distinctly marly..... 10'

3. Limestone: light grayish-white to cream, massive, poorly sorted, fine- to extremely coarse-grain, whole-mollusc and other-skeletal biomicrite; abundant fine-skeletal debris in matrix; molluscs predominantly caprinids and radiolites; unit weathers as one severely solutioned and honeycombed mass with numerous vertical fissures and cracks; other features:
--at 38-41: muddy and light-brown
--at 45-49: miliolid and mollusc-fragment biosparite
--at 49-52: coarse shell debris with scattered caprinids
--at 56-59: bedding thinner, more regular
--at 59: upper boundary not well exposed, but apparently abrupt; contact does not appear bored or iron-stained..... 33'

2. Limestone: light yellowish-gray, nodular to thin bedded, marly, miliolid and mollusc-fragment biomicrite grading upward to miliolid and mollusc-fragment biomicrite at top of interval..... 12.5'


EDWARDS GROUP
SEGOVIA FORMATION
BURT RANCH MEMBER
DOCTOR BURT ZONE
FORT TERRETT FORMATION
KIRSCHBERG EVAPORITE
ALLEN RANCH BRECCIA
100
80
60
40
20
0
8. Limestone: light grayish-brown, dense, brittle, medium-bedded to massive-bedded, miliolid and fine mollusc-fragment micrite; some micrite nearly lithographic, incipient brecciation in lower part of unit; abundant nodules of brown chert; burrows in base..... 9'
7. Crystalline limestone: light grayish-brown, massive, deeply solutioned and calichified fine- to coarse crystalline limestone and travertine intimately intermixed, some secondary pisoliths; other features:
--at 94-95: light-gray chert nodules
--at 105.5-107: becomes fine-crystalline..... 14.5'
6. Dolomite and limestone: medium-gray, fine- to medium-crystalline, thin- to medium-bedded dolomitized micrite and mollusc-fragment biomicrite with two-foot unit of light grayish-brown, incipiently-brecciated lithographic micrite at 86.5-88.5; dark grayish-brown chert nodules at 89.5..... 8.5'
5. Marly limestone and dolomitic limestone: light yellowish-gray and grayish brown, soft, nodular to lumpy, slightly granular, slightly argillaceous mollusc-fragment biomicrite and interbedded, fine-crystalline dolomitic micrite; scattered oyster shells, possibly Exogyra texana..... 15'
4. Marly limestone: light brownish-gray, nodular, punky, mostly deeply weathered, altered or covered, slightly argillaceous and marly, mollusc-fragment micrite and biomicrite; covered in basal three and a half feet, but this unit in nearby outcrops is distinctly marly..... 10'
3. Limestone: light grayish-white to cream, massive, poorly sorted, fine- to extremely coarse-grain, whole-mollusc and other-skeletal biomicrite; abundant fine-skeletal debris in matrix; molluscs predominantly caprinids and radiolites; unit weathers as one severely solutioned and honeycombed mass with numerous vertical fissures and cracks; other features:
--at 38-41: muddy and light-brown
--at 45-49: miliolid and mollusc-fragment biosparite
--at 49-52: coarse shell debris with scattered caprinids
--at 56-59: bedding thinner, more regular
--at 59: upper boundary not well exposed, but apparently abrupt; contact does not appear bored or iron-stained..... 33'
2. Limestone: light yellowish-gray, nodular to thin bedded, marly, miliolid and mollusc-fragment biomicrite grading upward to miliolid and mollusc-fragment biomicrite at top of interval..... 12.5'
1. Limestone: light grayish-brown, brittle, hard, thin- to medium-bedded, alternating lithographic micrite and medium- to fine-grain, miliolid and mollusc-fragment muddy biosparite and biomicrite; plus dark-gray, fine-crystalline micrite layers at 4, 7, 12; deeply weathered and altered recessive streaks at 5-6 and 9.5-10.5 may have been marly; dark gray chert nodules at 7; upper contact smooth and even..... 13.5'
LOCATION MAP
53
83
82
Ks
Cypress Creek
1796
LR
Little Creek
16
KERR COUNTY
BANDERA COUNTY
5 Miles

MEDINA MOUNTAIN



17. Limestone and marl: light yellowish-gray to cream, fine- to coarse-grain, moderately- to well-sorted, miliolid and mollusc-fragment biosparite and biomicrite interbedded with yellowish-brown, recessive, flaky, fissile to nodular, argillaceous micrite and biomicrite, other features:
    --at 242-245, 259, 261-262: biomicrite with scattered miliolids and fine-skeletal debris
    --at 252-255: very fine-grain, almost lithographic micrite with orange specks
    --at 263-267.5: thin-bedded miliolid biosparite
    --at 267.5: flat, pitted, red-stained, definitely bored bedding surface
    --at 267-275: marl, light grayish-brown, very thin-bedded to flaggy granular, very fine-grain, mollusc-fragment micrite and fissle flaky marly micrite..... 34'

16. Limestone: light-brown, dense, brittle, lithographic micrite with scattered miliolids and fine-skeletal debris..... 4'

15. Dolomite: dark- to medium-gray, very fine- to fine-crystalline, thin- to medium-bedded, dolomitized micrite; beds smooth and rounded; scattered light-gray to light-brown chert in nodules and ragged patches especially at 228-230 and 235-236; other features:
    --at 217-221: very dark-gray, fine-crystalline, dolomitized micrite with some incipient breccia at base
    --at 221-225: medium-gray, medium-crystalline limestone with some incipient breccia at base
    --at 236: brownish-gray chert bed..... 19.5'

14. Dolomite and crystalline limestone: dark- to medium-gray, medium- to fine-crystalline dolomite alternating with light-gray to light-brown, medium- to coarse-crystalline calcite and crystalline limestone; limestone altered in part to travertine and deep caliche; more deeply weathered streaks reddish, porous, soft, some honeycombed intervals not well exposed, light grayish-brown chert nodules..... 23.5'

13. Dolomite, travertine, and crystalline limestone: medium-gray, medium- to coarse-crystalline, honeycombed (burrowed?) dolomite with a five-foot layer of crystalline limestone, travertine and cave-stone below; white and gray chert at 187-189; covered in upper 2 feet..... 13'

12. Limestone: light grayish-yellow, massive, medium- to coarse-grain, moderately-sorted mollusc-fragment and miliolid biosparite; coarse lime-sand bank with flat, abrupt upper boundary..... 4'

11. Crystalline limestone: light-brown to medium grayish-brown, medium- to thin-bedded, slightly and finely-recrystallized, mollusc-fragment micrite with scattered shelly streaks; original textures still discernable; other features:
    --at 163, 166: Toucasia
    --at 165-166, 170-171, 174: common light-gray chert nodules
    --at 168.5-171.5: laminated beds with alternating mud and sand streaks..... 15'

10. Dolomite: dull, medium brownish-gray, soft, punky, medium-crystalline, recessive, dolomitized, burrowed mollusc-fragment biomicrite; crusts at base..... 4'

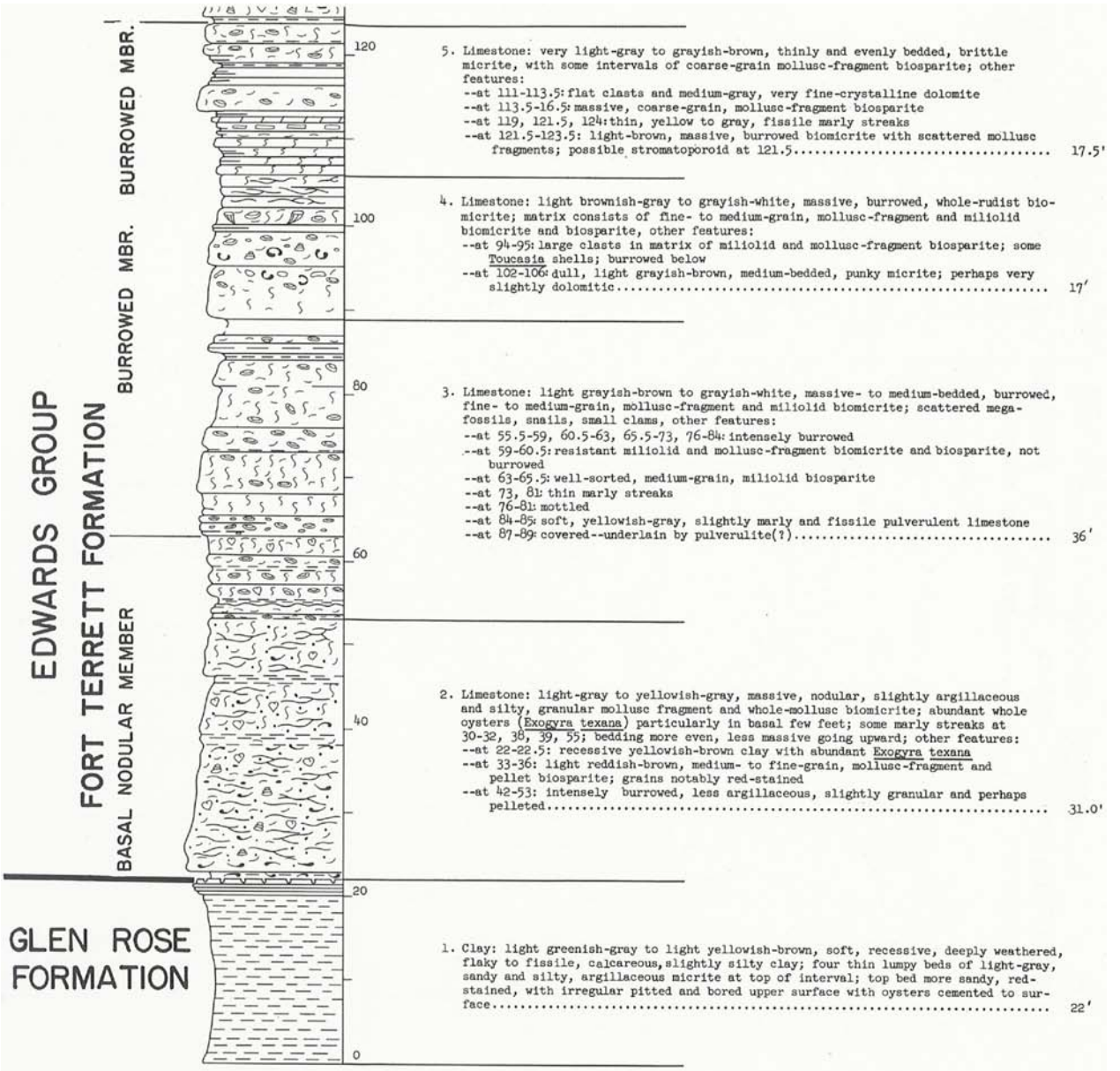
9. Limestone: light grayish-yellow to very light-gray, massive, burrowed, caprinid biomicrite overlain by medium-bedded, miliolid and mollusc-fragment biomicrite and poorly-washed biosparite; altered interval at 153; upper boundary abrupt..... 8'

8. Dolomite: dull medium-brownish-gray, fine- to medium-crystalline, porous, intensely burrowed, dolomitized, mollusc-fragment biomicrite, upper part recessive, poorly-exposed..... 5'

7. Limestone: very light grayish-brown to cream, medium- to coarse-grain, mollusc-fragment and miliolid biosparite and fine-grain biomicrite (below); coarse-grain biosparite has horizontal current streaks; upper contact abrupt and irregular with 1" to 2" relief.; finely recrystallized below, in part..... 9.5'

6. Marly limestone: light brownish-gray, nodular, slightly argillaceous in part, fine-grain, mollusc-fragment and miliolid micrite and biomicrite; looks like rock at 25-50, but less argillaceous, some burrowing..... 12'

5. Limestone: very light-gray to grayish-brown, thinly and evenly bedded, brittle micrite, with some intervals of coarse-grain mollusc-fragment biosparite; other features:
    --at 111-113.5: flat clasts and medium-gray, very fine-crystalline dolomite
    --at 113.5-16.5: massive, coarse-grain, mollusc-fragment biosparite
    --at 119, 121.5, 124: thin, yellow to gray, fissile marly streaks
    --at 121.5-123.5: light-brown, massive, burrowed biomicrite with scattered mollusc fragments; possible stromatoporoid at 121.5..... 17.5'



5. Limestone: very light-gray to grayish-brown, thinly and evenly bedded, brittle micrite, with some intervals of coarse-grain mollusc-fragment biosparite; other features:
--at 111-113.5: flat clasts and medium-gray, very fine-crystalline dolomite
--at 113.5-16.5: massive, coarse-grain, mollusc-fragment biosparite
--at 119, 121.5, 124: thin, yellow to gray, fissile marly streaks
--at 121.5-123.5: light-brown, massive, burrowed biomicrite with scattered mollusc fragments; possible stromatoporoid at 121.5..... 17.5'

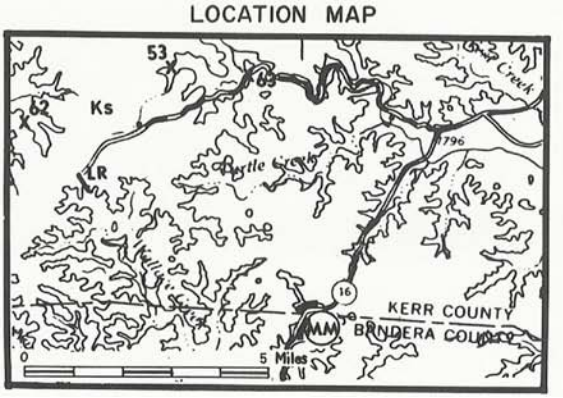
4. Limestone: light brownish-gray to grayish-white, massive, burrowed, whole-rudist biomicrite; matrix consists of fine- to medium-grain, mollusc-fragment and miliolid biomicrite and biosparite, other features:
--at 94-95: large clasts in matrix of miliolid and mollusc-fragment biosparite; some Toucasia shells; burrowed below
--at 102-106: dull, light grayish-brown, medium-bedded, punky micrite; perhaps very slightly dolomitic..... 17'

3. Limestone: light grayish-brown to grayish-white, massive- to medium-bedded, burrowed, fine- to medium-grain, mollusc-fragment and miliolid biomicrite; scattered megafossils, snails, small clams, other features:
--at 55.5-59, 60.5-63, 65.5-73, 76-84: intensely burrowed
--at 59-60.5: resistant miliolid and mollusc-fragment biomicrite and biosparite, not burrowed
--at 63-65.5: well-sorted, medium-grain, miliolid biosparite
--at 73, 81: thin marly streaks
--at 76-81: mottled
--at 84-85: soft, yellowish-gray, slightly marly and fissile pulverulent limestone
--at 87-89: covered--underlain by pulverulite(?)..... 36'

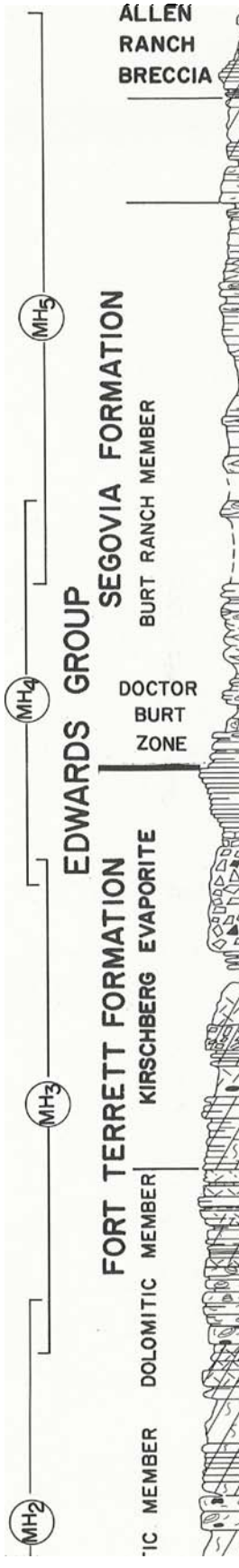
2. Limestone: light-gray to yellowish-gray, massive, nodular, slightly argillaceous and silty, granular mollusc fragment and whole-mollusc biomicrite; abundant whole oysters (Exogyra texana) particularly in basal few feet; some marly streaks at 30-32, 38, 39, 55; bedding more even, less massive going upward; other features:
--at 22-22.5: recessive yellowish-brown clay with abundant Exogyra texana
--at 33-36: light reddish-brown, medium- to fine-grain, mollusc-fragment and pellet biosparite; grains notably red-stained
--at 42-53: intensely burrowed, less argillaceous, slightly granular and perhaps pelleted..... 31.0'

1. Clay: light greenish-gray to light yellowish-brown, soft, recessive, deeply weathered, flaky to fissile, calcareous, slightly silty clay; four thin lumpy beds of light-gray, sandy and silty, argillaceous micrite at top of interval; top bed more sandy, red-stained, with irregular pitted and bored upper surface with oysters cemented to surface..... 22'

LOCATION MAP



MOUNTAIN HOME COMPOSITE



20. Dolomite: medium-gray, variable dolomitized micrite and dolomitized micrite breccia; other features:
--at 305-307, 312-316, 321-322: dense, tight, laminated dolomitized micrite
--at 307-311.5: massive, featureless, porous, fine-crystalline dolomite
--at 310-316: beds grade laterally to collapse breccia
--at 316-321: poorly exposed, very coarse, dolomitized collapse-breccia..... 17'

19. Limestone: light grayish-cream, medium-grain, well-sorted, mollusc-fragment and miliolid biosparite; resistant bench-former; orange clay streak at top..... 5'

18. Marl and limestone: light yellowish-gray, soft, nodular to fissile, fossiliferous, argillaceous micrite with thin, resistant interbeds of light yellowish-gray, nodular medium- to fine-grain, miliolid and mollusc-fragment biosparite and biomicrite; other features:
--at 238-241: yellow-weathering soft marl with Exogyra texana, protocardid clams; marl rests on lumpy, somewhat red-stained, surface
--at 250-255: resistant ledges of miliolid biomicrite and biosparite
--at 255-263, 263-265: covered slope, probably marl
--at 273: small clams--Cyprimeria, etc.
--at 282-288: becomes more resistant, less fissile, blocky -weathering, less argillaceous, fine mollusc-fragment biosparite
--at 290: hard, muddy miliod and mollusck-fragment biosparite
--at 290.5-293.5: fissile, brittle, white, hard granular marl
--at 293.5-298.5: nodular and burrowed
--at 298.5-300: well-bedded but still marly..... 62'

17. Limestone: light yellowish-gray, thin-bedded to nodular micrite and miliolid biosparite with thin marly interbeds..... 4'

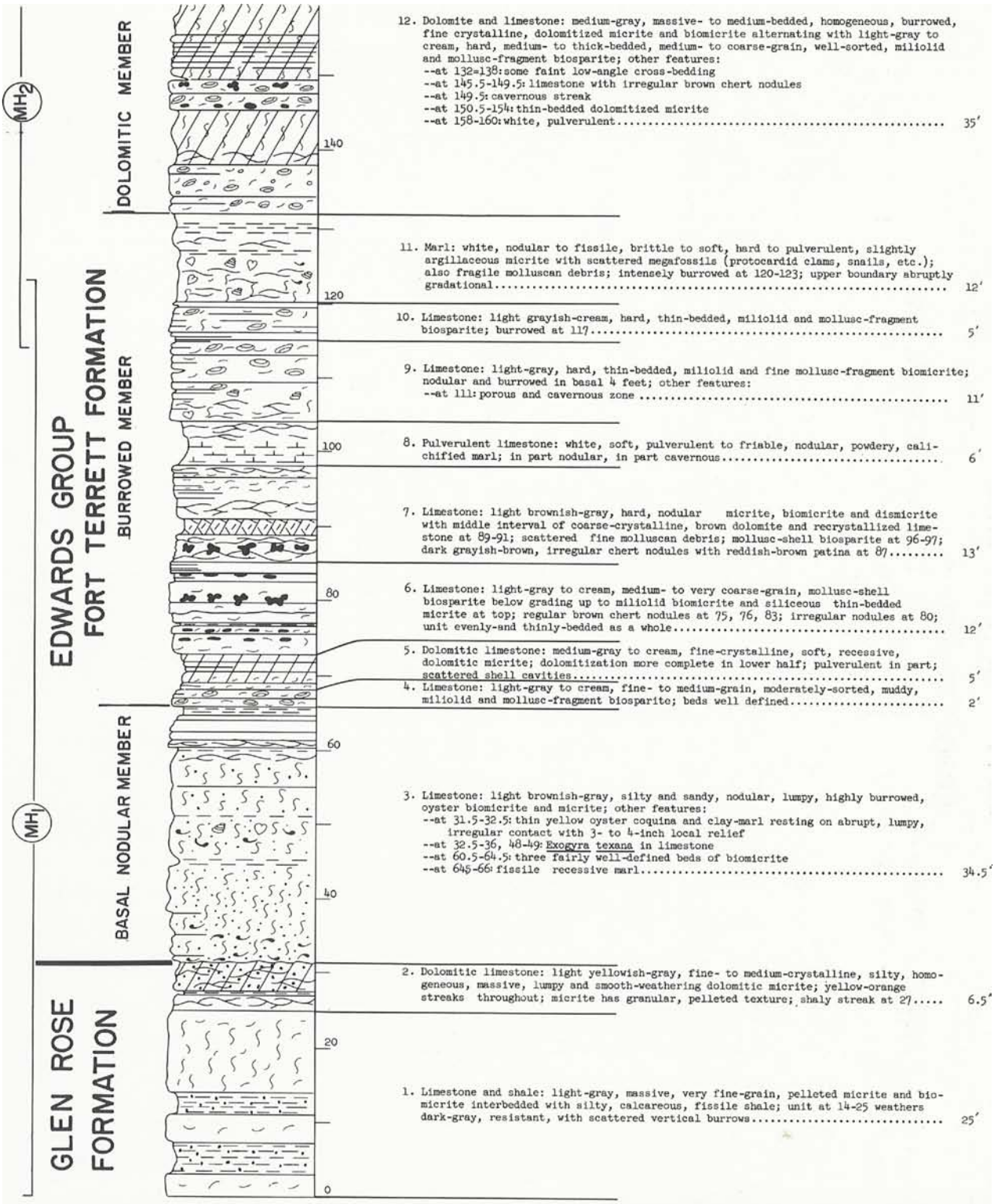
16. Limestone: light brownish-gray, thin-bedded, brittle, lithographic micrite with scattered, fine molluscan debris and miliolids; some incipient brecciation and fracturing in lower 2 feet, unit grades into breccia below..... 9'

15. Limestone breccia and altered limestone: light- to medium-gray, dense to porous, solutioned in part, dolomitized in part, very coarse, limestone, dolomite and chert fragment breccia; breccia occurs as two layers at bottom and top of interval; lower breccia grades laterally to thin-bedded dolomite; interval between consists of three layers; other features:
--at 204-208.5: medium-crystalline, very porous, recrystallized dolomite with network texture
--at 208.5-210.5: yellow, nodular, cavernous, pulverulent limestone
--at 210.5-212.5: yellowish-brown, nodular, layered, very coarse-crystalline, recrystallized limestone..... 24'

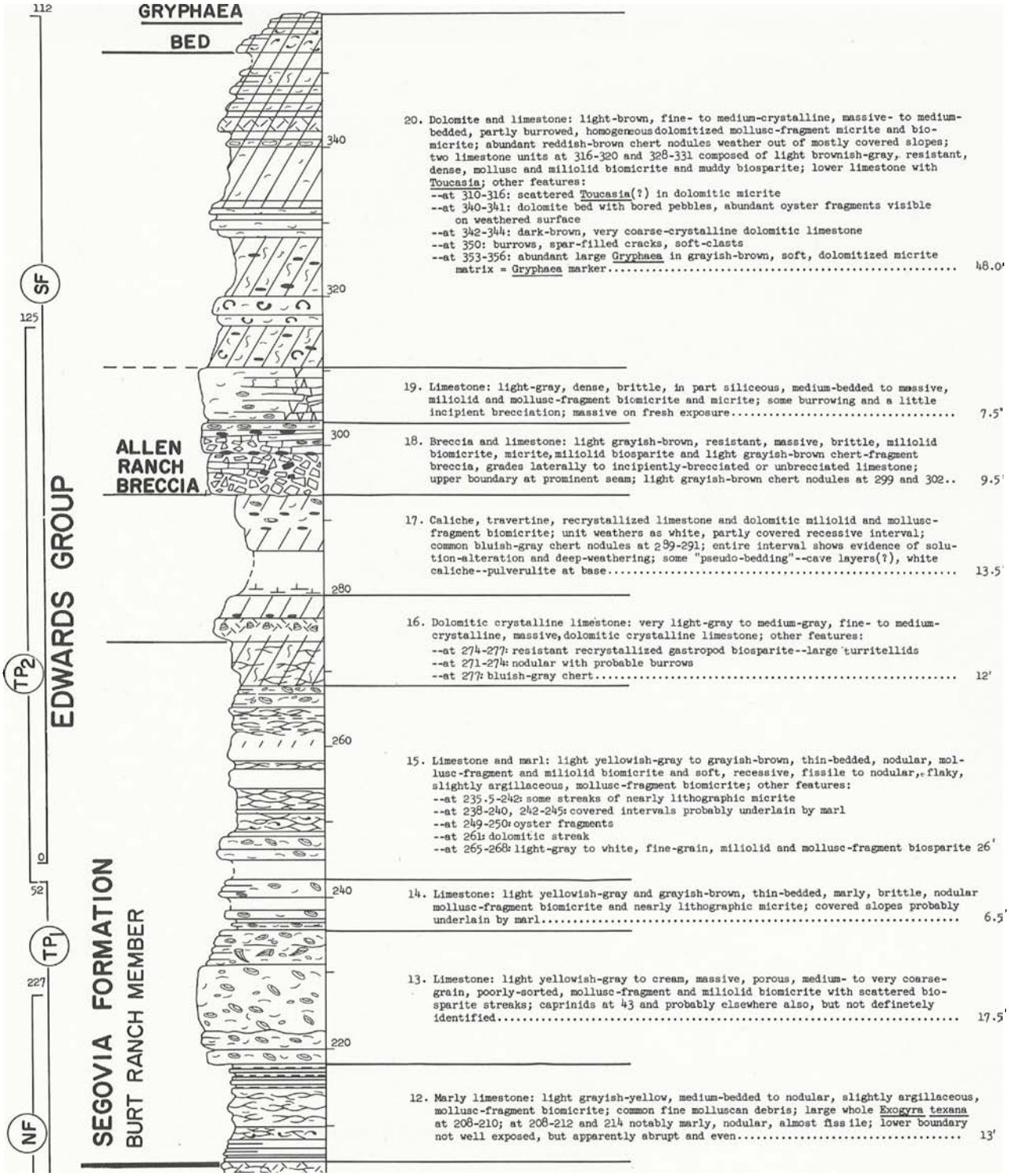
14. Dolomite and crystalline limestone: light- to medium-gray, thin- to medium-bedded, fine- to coarse-crystalline limestone and dolomite; in part cavernous and coarsely-crystalline; vestigial bedding apparent from 176-187, but unit is massive, nodular, solutioned and mostly pulverulent to 193; burrow fills apparent 190-193; yellow seam at 180; brecciated in part at 195..... 24.5'

13. Limestone: light-gray to cream, evenly-bedded, fine- to coarse-grain, moderately- to well-sorted, mollusc-fragment and miliolid biosparite; other features as follows:
--at 167, 175: muddy streaks
--at 167, 169: elongate grayish-brown chert nodules
--at 172: resistant, very coarse biosparite with Turritella; pitted surface texture.. 9.5'

12. Dolomite and limestone: medium-gray, massive- to medium-bedded, homogeneous, burrowed, fine crystalline, dolomitized micrite and biomicrite alternating with light-gray to cream, hard, medium- to thick-bedded, medium- to coarse-grain, well-sorted, miliolid and mollusc-fragment biosparite; other features:
--at 132-138: some faint low-angle cross-bedding
--at 145.5-149.5: limestone with irregular brown chert nodules
--at 149.5: cavernous streak
--at 150.5-154: thin-bedded dolomitized micrite
--at 158-160: white, pulverulent..... 35'


MH2
MH1
EDWARDS GROUP
FORT TERRETT FORMATION
DOLOMITIC MEMBER
BURROWED MEMBER
BASAL NODULAR MEMBER
GLEN ROSE FORMATION
140
120
100
80
60
40
20
0
12. Dolomite and limestone: medium-gray, massive- to medium-bedded, homogeneous, burrowed, fine crystalline, dolomitized micrite and biomicrite alternating with light-gray to cream, hard, medium- to thick-bedded, medium- to coarse-grain, well-sorted, miliolid and mollusc-fragment biosparite; other features:
--at 132-138: some faint low-angle cross-bedding
--at 145.5-149.5: limestone with irregular brown chert nodules
--at 149.5: cavernous streak
--at 150.5-154: thin-bedded dolomitized micrite
--at 158-160: white, pulverulent ..... 35'
11. Marl: white, nodular to fissile, brittle to soft, hard to pulverulent, slightly argillaceous micrite with scattered megafossils (protocardid clams, snails, etc.); also fragile molluscan debris; intensely burrowed at 120-123; upper boundary abruptly gradational ..... 12'
10. Limestone: light grayish-cream, hard, thin-bedded, miliolid and mollusc-fragment biosparite; burrowed at 117 ..... 5'
9. Limestone: light-gray, hard, thin-bedded, miliolid and fine mollusc-fragment biomicrite; nodular and burrowed in basal 4 feet; other features:
--at 111: porous and cavernous zone ..... 11'
8. Pulverulent limestone: white, soft, pulverulent to friable, nodular, powdery, calichified marl; in part nodular, in part cavernous ..... 6'
7. Limestone: light brownish-gray, hard, nodular micrite, biomicrite and dismicrite with middle interval of coarse-crystalline, brown dolomite and recrystallized limestone at 89-91; scattered fine molluscan debris; mollusc-shell biosparite at 96-97; dark grayish-brown, irregular chert nodules with reddish-brown patina at 87 ..... 13'
6. Limestone: light-gray to cream, medium- to very coarse-grain, mollusc-shell biosparite below grading up to miliolid biomicrite and siliceous thin-bedded micrite at top; regular brown chert nodules at 75, 76, 83; irregular nodules at 80; unit evenly-and thinly-bedded as a whole ..... 12'
5. Dolomitic limestone: medium-gray to cream, fine-crystalline, soft, recessive, dolomitic micrite; dolomitization more complete in lower half; pulverulent in part; scattered shell cavities ..... 5'
4. Limestone: light-gray to cream, fine- to medium-grain, moderately-sorted, muddy, miliolid and mollusc-fragment biosparite; beds well defined ..... 2'
3. Limestone: light brownish-gray, silty and sandy, nodular, lumpy, highly burrowed, oyster biomicrite and micrite; other features:
--at 31.5-32.5: thin yellow oyster coquina and clay-marl resting on abrupt, lumpy, irregular contact with 3- to 4-inch local relief
--at 32.5-36, 48-49: Exogyra texana in limestone
--at 60.5-64.5: three fairly well-defined beds of biomicrite
--at 645-66: fissile recessive marl ..... 34.5'
2. Dolomitic limestone: light yellowish-gray, fine- to medium-crystalline, silty, homogeneous, massive, lumpy and smooth-weathering dolomitic micrite; yellow-orange streaks throughout; micrite has granular, pelleted texture; shaly streak at 27 ..... 6.5'
1. Limestone and shale: light-gray, massive, very fine-grain, pelleted micrite and biomicrite interbedded with silty, calcareous, fissile shale; unit at 14-25 weathers dark-gray, resistant, with scattered vertical burrows ..... 25'
LOCATION MAP
MH5
2094
27
COUNTY
MH4
MH3
MH2
41
Mountain Home
1913
KERR
GILLESPIE
5 Miles
Hatchery
64
MH1

NORTH FORK COMPOSITE



20. Dolomite and limestone: light-brown, fine- to medium-crystalline, massive- to medium-bedded, partly burrowed, homogeneous dolomitized mollusc-fragment micrite and biomicrite; abundant reddish-brown chert nodules weather out of mostly covered slopes; two limestone units at 316-320 and 328-331 composed of light brownish-gray, resistant, dense, mollusc and miliolid biomicrite and muddy biosparite; lower limestone with Toucasia; other features:
--at 310-316: scattered Toucasia(?) in dolomitic micrite
--at 340-341: dolomite bed with bored pebbles, abundant oyster fragments visible on weathered surface
--at 342-344: dark-brown, very coarse-crystalline dolomitic limestone
--at 350: burrows, spar-filled cracks, soft-clasts
--at 353-356: abundant large Gryphaea in grayish-brown, soft, dolomitized micrite matrix = Gryphaea marker..... 48.0'

19. Limestone: light-gray, dense, brittle, in part siliceous, medium-bedded to massive, miliolid and mollusc-fragment biomicrite and micrite; some burrowing and a little incipient brecciation; massive on fresh exposure..... 7.5'

18. Breccia and limestone: light grayish-brown, resistant, massive, brittle, miliolid biomicrite, micrite, miliolid biosparite and light grayish-brown chert-fragment breccia, grades laterally to incipiently-brecciated or unbrecciated limestone; upper boundary at prominent seam; light grayish-brown chert nodules at 299 and 302.. 9.5'

17. Caliche, travertine, recrystallized limestone and dolomitic miliolid and mollusc-fragment biomicrite; unit weathers as white, partly covered recessive interval; common bluish-gray chert nodules at 289-291; entire interval shows evidence of solution-alteration and deep-weathering; some "pseudo-bedding"--cave layers(?), white caliche--pulverulite at base..... 13.5'

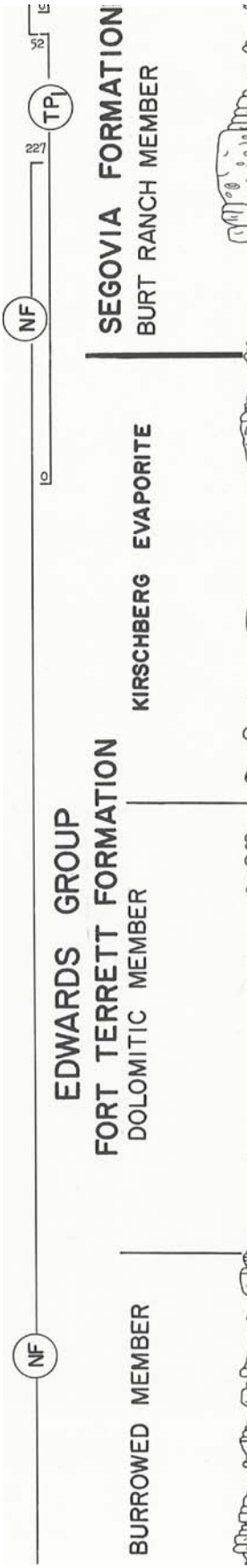
16. Dolomitic crystalline limestone: very light-gray to medium-gray, fine- to medium-crystalline, massive, dolomitic crystalline limestone; other features:
--at 274-277: resistant recrystallized gastropod biosparite--large turritellids
--at 271-274: nodular with probable burrows
--at 277: bluish-gray chert..... 12'

15. Limestone and marl: light yellowish-gray to grayish-brown, thin-bedded, nodular, mollusc-fragment and miliolid biomicrite and soft, recessive, fissile to nodular, flaky, slightly argillaceous, mollusc-fragment biomicrite; other features:
--at 235.5-242: some streaks of nearly lithographic micrite
--at 238-240, 242-245: covered intervals probably underlain by marl
--at 249-250: oyster fragments
--at 261: dolomitic streak
--at 265-268: light-gray to white, fine-grain, miliolid and mollusc-fragment biosparite 26'

14. Limestone: light yellowish-gray and grayish-brown, thin-bedded, marly, brittle, nodular mollusc-fragment biomicrite and nearly lithographic micrite; covered slopes probably underlain by marl..... 6.5'

13. Limestone: light yellowish-gray to cream, massive, porous, medium- to very coarse-grain, poorly-sorted, mollusc-fragment and miliolid biomicrite with scattered biosparite streaks; caprinids at 43 and probably elsewhere also, but not definetely identified..... 17.5'

12. Marly limestone: light grayish-yellow, medium-bedded to nodular, slightly argillaceous, mollusc-fragment biomicrite; common fine molluscan debris; large whole Exogyra texana at 208-210; at 208-212 and 214 notably marly, nodular, almost fissile; lower boundary not well exposed, but apparently abrupt and even..... 13'



14. Limestone: light yellowish-gray and grayish-brown, thin-bedded, marly, brittle, nodular mollusc-fragment biomicrite and nearly lithographic micrite; covered slopes probably underlain by marl..... 6.5'

13. Limestone: light yellowish-gray to cream, massive, porous, medium- to very coarse-grain, poorly-sorted, mollusc-fragment and miliolid biomicrite with scattered biosparite streaks; caprinids at 43 and probably elsewhere also, but not definetely identified..... 17.5'

12. Marly limestone: light grayish-yellow, medium-bedded to nodular, slightly argillaceous, mollusc-fragment biomicrite; common fine molluscan debris; large whole Exogyra texana at 208-210; at 208-212 and 214 notably marly, nodular, almost fissile; lower boundary not well exposed, but apparently abrupt and even..... 13'

11. Limestone breccia and recrystallized limestone: light grayish-brown, massive, very coarse collapse breccia composed of lithographic micrite, miliolid biomicrite and bluish-gray chert; breccia grades laterally to thin-bedded, brittle micrite and biomicrite, especially at 198-201; at 201-205 yellowish brown, very fine-crystalline, thin-bedded limestone; some coarse-recrystallization at base; brecciation not chaotic or severe--much incipient brecciation..... 15'

10. Crystalline limestone, dolomite and collapse breccia: light-brown to medium-gray, massive, porous, honeycombed, hard to punky, very coarse-crystalline, partly dolomitic, partly brecciated, cherty crystalline limestone; deeply altered and poorly exposed; other features:
--at 172-176, 182-184, 187-190: collapse breccias
--at 177-182, 184-187: abundant brown chert nodules
--at 187-190: collapse breccia composed of dark-gray dolomite and crystalline limestone 24'

9. Dolomitic crystalline limestone: light-brown to medium-gray, medium to very coarse crystalline, massive, slightly dolomitic micrite and mollusc-fragment biomicrite; other features:
--at 154-157: coarse-grain shell fragments
--at 159: light-brown recrystallized micrite..... 14'

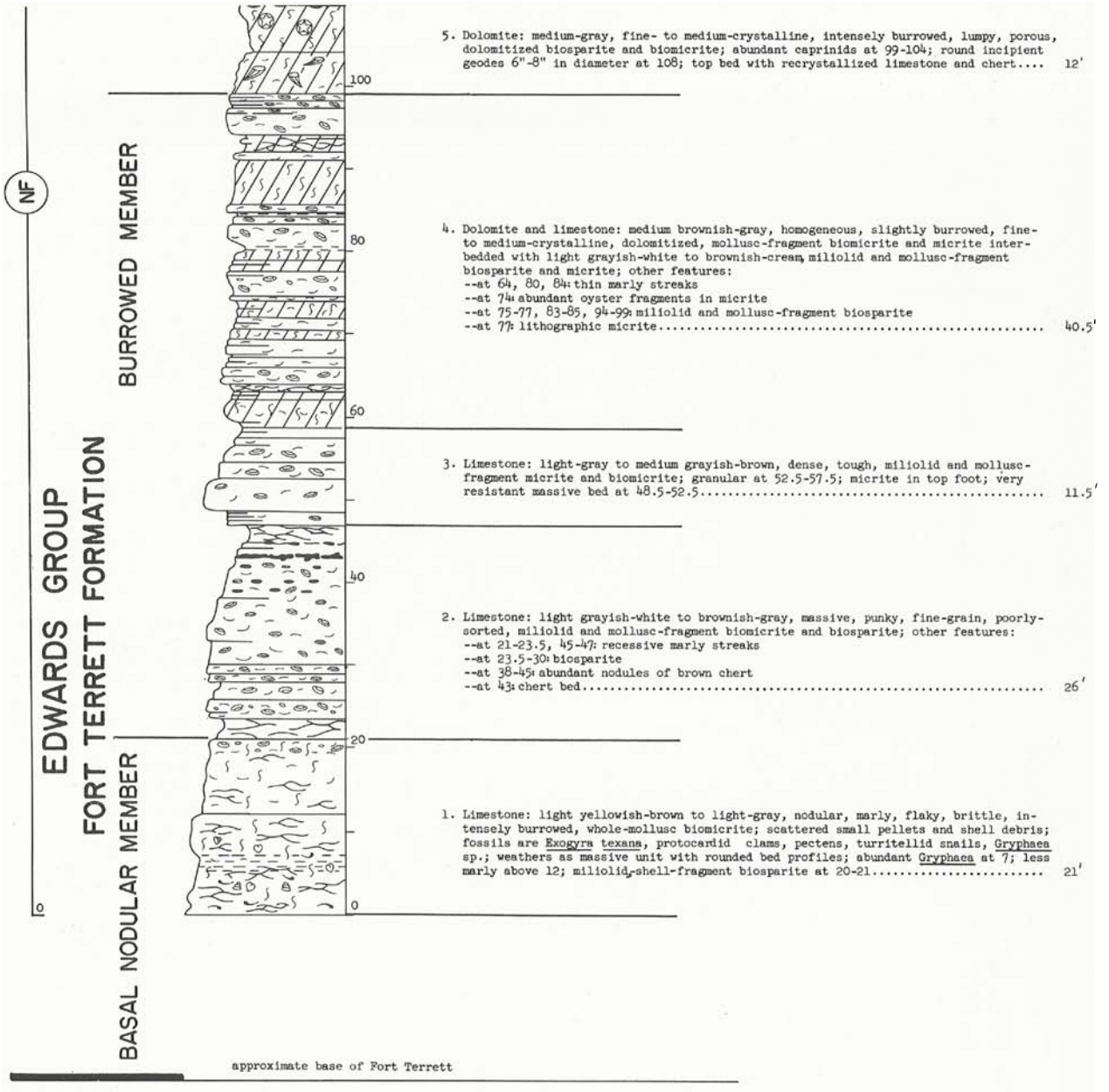
8. Dolomite: medium-gray to light grayish-brown, massive- to medium-bedded, dense to punky, fine- to coarse-crystalline, essentially featureless dolomite; other features:
--at 140: coarse-crystalline limestone
--at 143-144: very coarse-crystalline
--at 145: burrowed
--at 150: grayish-brown chert nodules..... 14.0'

7. Limestone: light grayish-white to cream, medium- to coarse-grain, moderately-sorted, pelecypod biosparite and biomicrite; medium-bedded, punky in upper two feet; basal beds resistant, upper beds recessive..... 6'

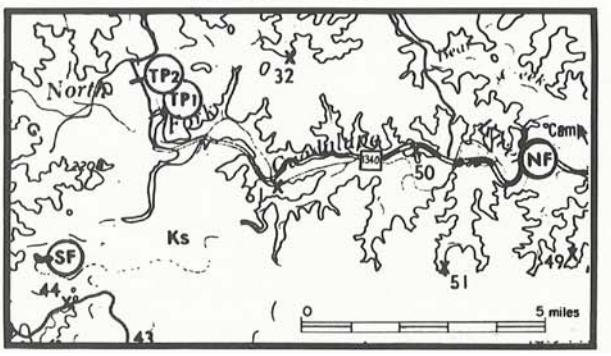
6. Dolomite: medium-gray, medium- to fine-crystalline, massive, smooth weathering dolomite; other features:
--at 111-113.5: light grayish-brown, medium-grain, miliolid and mollusc-fragment biosparite grading up to mollusc-fragment micrite
--at 117-118: light brownish-gray chert nodules
--at 120-123.5: cavernous..... 21'

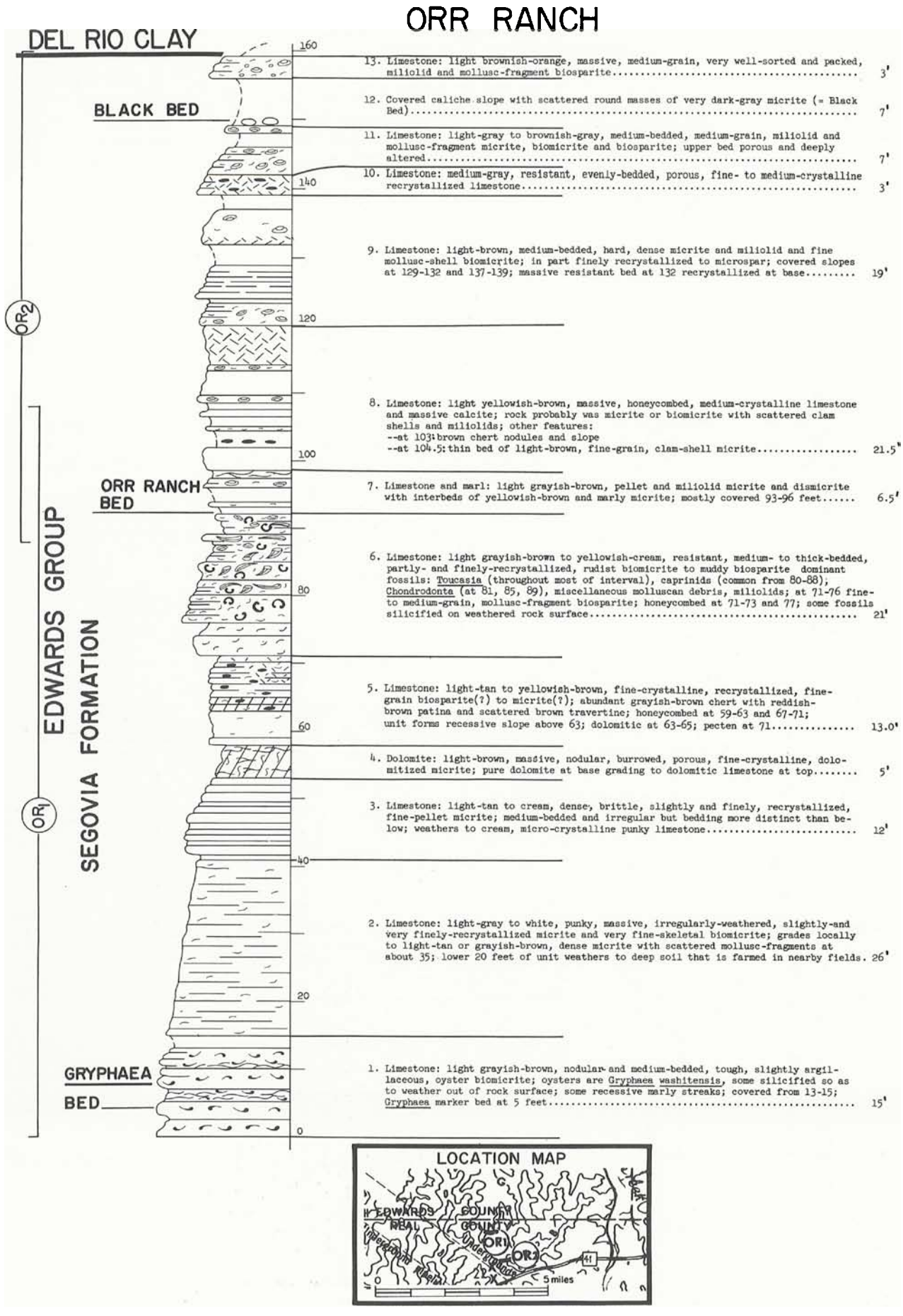
5. Dolomite: medium-gray, fine- to medium-crystalline, intensely burrowed, lumpy, porous, dolomitized biosparite and biomicrite; abundant caprinids at 99-104; round incipient geodes 6"-8" in diameter at 108; top bed with recrystallized limestone and chert.... 12'

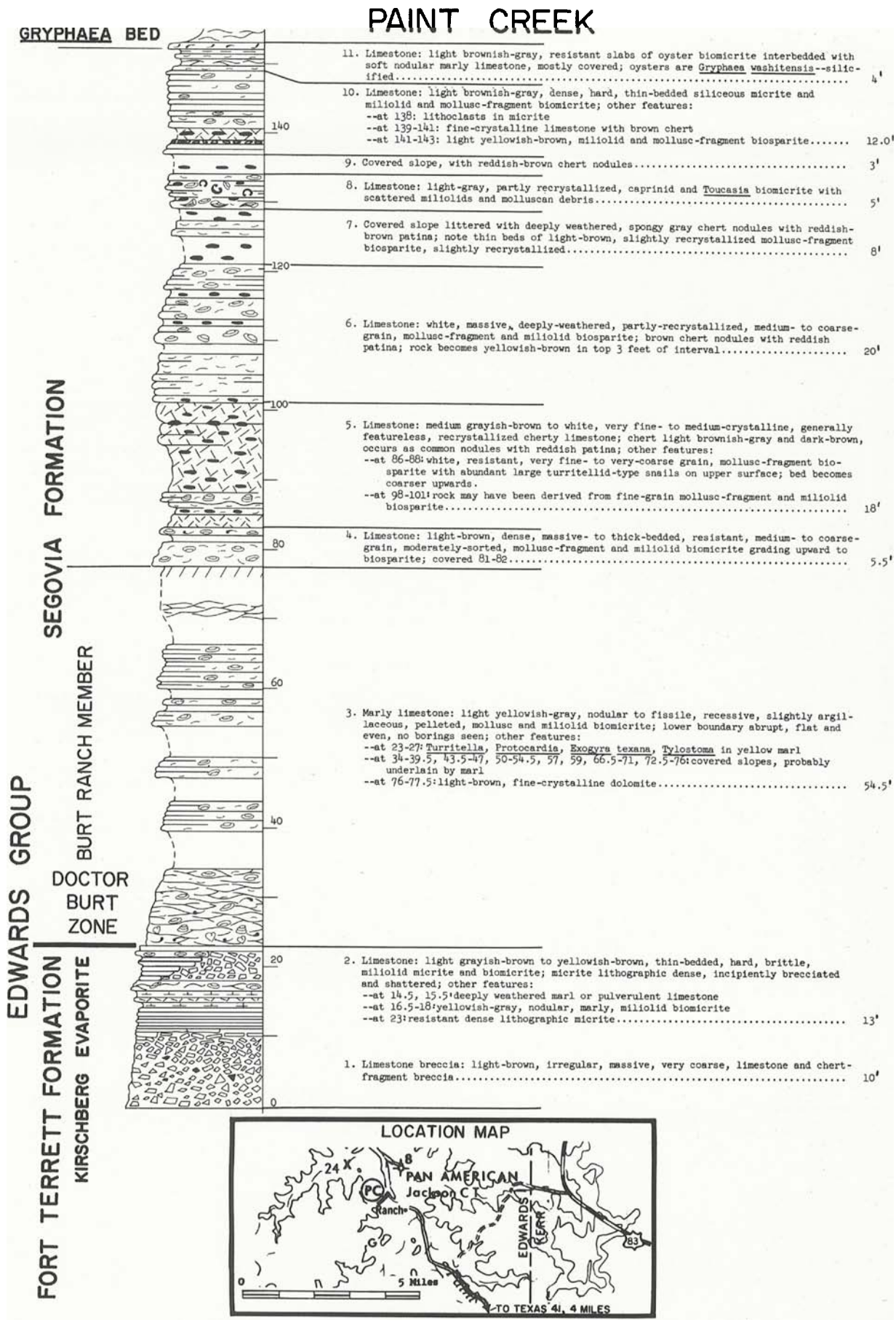
4. Dolomite and limestone: medium brownish-gray, homogeneous, slightly burrowed, fine- to medium-crystalline, dolomitized, mollusc-fragment biomicrite and micrite interbedded with light grayish-white to brownish-cream, miliolid and mollusc-fragment biosparite and micrite; other features:
--at 64, 80, 84: thin marly streaks
--at 74: abundant oyster fragments in micrite
--at 75-77, 83-85, 94-99: miliolid and mollusc-fragment biosparite
--at 77: lithographic micrite..... 40.5'



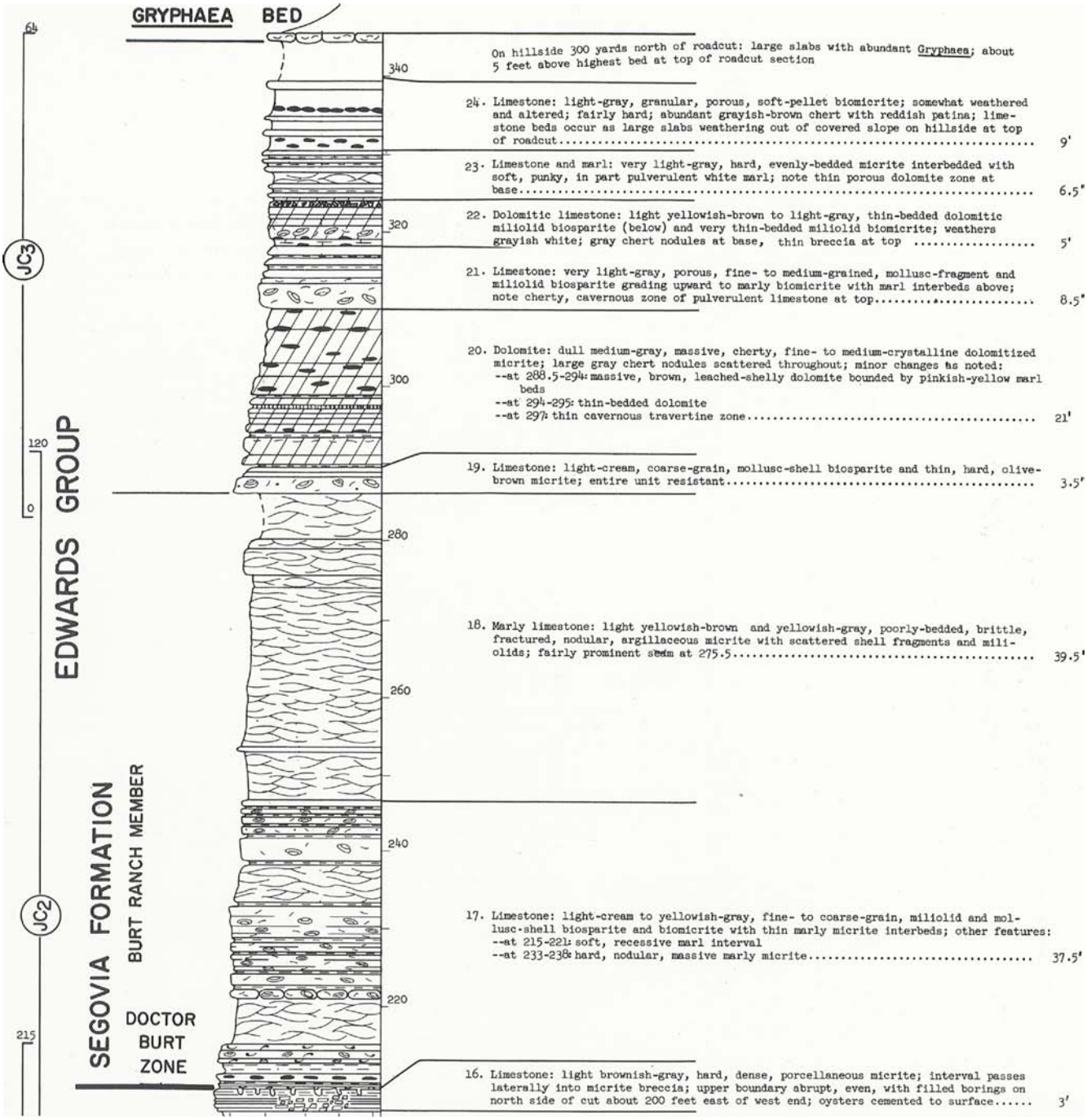
LOCATION MAP




ORR RANCH
DEL RIO CLAY
BLACK BED
ORR RANCH BED
GRYPHAEA BED
EDWARDS GROUP
SEGOVIA FORMATION
OR2
OR1
160
140
120
100
80
60
40
20
0
13. Limestone: light brownish-orange, massive, medium-grain, very well-sorted and packed, miliolid and mollusc-fragment biosparite..... 3'
12. Covered caliche slope with scattered round masses of very dark-gray micrite (= Black Bed)..... 7'
11. Limestone: light-gray to brownish-gray, medium-bedded, medium-grain, miliolid and mollusc-fragment micrite, biomicrite and biosparite; upper bed porous and deeply altered..... 7'
10. Limestone: medium-gray, resistant, evenly-bedded, porous, fine- to medium-crystalline recrystallized limestone..... 3'
9. Limestone: light-brown, medium-bedded, hard, dense micrite and miliolid and fine mollusc-shell biomicrite; in part finely recrystallized to microspar; covered slopes at 129-132 and 137-139; massive resistant bed at 132 recrystallized at base..... 19'
8. Limestone: light yellowish-brown, massive, honeycombed, medium-crystalline limestone and massive calcite; rock probably was micrite or biomicrite with scattered clam shells and miliolids; other features:
--at 103: brown chert nodules and slope
--at 104.5: thin bed of light-brown, fine-grain, clam-shell micrite..... 21.5'
7. Limestone and marl: light grayish-brown, pellet and miliolid micrite and dismicrite with interbeds of yellowish-brown and marly micrite; mostly covered 93-96 feet..... 6.5'
6. Limestone: light grayish-brown to yellowish-cream, resistant, medium- to thick-bedded, partly- and finely-recrystallized, rudist biomicrite to muddy biosparite dominant fossils: Toucasia (throughout most of interval), caprinids (common from 80-88); Chondrodonta (at 81, 85, 89), miscellaneous molluscan debris, miliolids; at 71-76 fine- to medium-grain, mollusc-fragment biosparite; honeycombed at 71-73 and 77; some fossils silicified on weathered rock surface..... 21'
5. Limestone: light-tan to yellowish-brown, fine-crystalline, recrystallized, fine-grain biosparite(?) to micrite(?); abundant grayish-brown chert with reddish-brown patina and scattered brown travertine; honeycombed at 59-63 and 67-71; unit forms recessive slope above 63; dolomitic at 63-65; pecten at 71..... 13.0'
4. Dolomite: light-brown, massive, nodular, burrowed, porous, fine-crystalline, dolomitized micrite; pure dolomite at base grading to dolomitic limestone at top..... 5'
3. Limestone: light-tan to cream, dense, brittle, slightly and finely, recrystallized, fine-pellet micrite; medium-bedded and irregular but bedding more distinct than below; weathers to cream, micro-crystalline punky limestone..... 12'
2. Limestone: light-gray to white, punky, massive, irregularly-weathered, slightly-and very finely-recrystallized micrite and very fine-skeletal biomicrite; grades locally to light-tan or grayish-brown, dense micrite with scattered mollusc-fragments at about 35; lower 20 feet of unit weathers to deep soil that is farmed in nearby fields. 26'
1. Limestone: light grayish-brown, nodular and medium-bedded, tough, slightly argillaceous, oyster biomicrite; oysters are Gryphaea washitensis, some silicified so as to weather out of rock surface; some recessive marly streaks; covered from 13-15; Gryphaea marker bed at 5 feet..... 15'
LOCATION MAP
EDWARDS COUNTY
REAL COUNTY
OR1
OR2
Underground Water
5 miles


PAINT CREEK
GRYPHAEA BED
EDWARDS GROUP
FORT TERRETT FORMATION
KIRSCHBERG EVAPORITE
DOCTOR
BURT
ZONE
BURT RANCH MEMBER
SEGOVIA FORMATION
140
120
100
80
60
40
20
0
11. Limestone: light brownish-gray, resistant slabs of oyster biomicrite interbedded with soft nodular marly limestone, mostly covered; oysters are Gryphaea washitensis--silicified..... 4'
10. Limestone: light brownish-gray, dense, hard, thin-bedded siliceous micrite and miliolid and mollusc-fragment biomicrite; other features:
--at 138: lithoclasts in micrite
--at 139-141: fine-crystalline limestone with brown chert
--at 141-143: light yellowish-brown, miliolid and mollusc-fragment biosparite..... 12.0'
9. Covered slope, with reddish-brown chert nodules..... 3'
8. Limestone: light-gray, partly recrystallized, caprinid and Toucasia biomicrite with scattered miliolids and molluscan debris..... 5'
7. Covered slope littered with deeply weathered, spongy gray chert nodules with reddish-brown patina; note thin beds of light-brown, slightly recrystallized mollusc-fragment biosparite, slightly recrystallized..... 8'
6. Limestone: white, massive, deeply-weathered, partly-recrystallized, medium- to coarse-grain, mollusc-fragment and miliolid biosparite; brown chert nodules with reddish patina; rock becomes yellowish-brown in top 3 feet of interval..... 20'
5. Limestone: medium grayish-brown to white, very fine- to medium-crystalline, generally featureless, recrystallized cherty limestone; chert light brownish-gray and dark-brown, occurs as common nodules with reddish patina; other features:
--at 86-88: white, resistant, very fine- to very-coarse grain, mollusc-fragment biosparite with abundant large turritellid-type snails on upper surface; bed becomes coarser upwards.
--at 98-101: rock may have been derived from fine-grain mollusc-fragment and miliolid biosparite..... 18'
4. Limestone: light-brown, dense, massive- to thick-bedded, resistant, medium- to coarse-grain, moderately-sorted, mollusc-fragment and miliolid biomicrite grading upward to biosparite; covered 81-82..... 5.5'
3. Marly limestone: light yellowish-gray, nodular to fissile, recessive, slightly argillaceous, pelleted, mollusc and miliolid biomicrite; lower boundary abrupt, flat and even, no borings seen; other features:
--at 23-27: Turritella, Protocardia, Exogyra texana, Tylostoma in yellow marl
--at 34-39.5, 43.5-47, 50-54.5, 57, 59, 66.5-71, 72.5-76: covered slopes, probably underlain by marl
--at 76-77.5: light-brown, fine-crystalline dolomite..... 54.5'
2. Limestone: light grayish-brown to yellowish-brown, thin-bedded, hard, brittle, miliolid micrite and biomicrite; micrite lithographic dense, incipiently brecciated and shattered; other features:
--at 14.5, 15.5: deeply weathered marl or pulverulent limestone
--at 16.5-18: yellowish-gray, nodular, marly, miliolid biomicrite
--at 23: resistant dense lithographic micrite..... 13'
1. Limestone breccia: light-brown, irregular, massive, very coarse, limestone and chert-fragment breccia..... 10'
LOCATION MAP
PAN AMERICAN
Jackson C.T.
Ranch
EDWARDS
CERR.
83
5 Miles
TO TEXAS 41, 4 MILES

SEGOVIA COMPOSITE



17. Limestone: light-cream to yellowish-gray, fine- to coarse-grain, miliolid and mollusc-shell biosparite and biomicrite with thin marly micrite interbeds; other features:
--at 215-221: soft, recessive marl interval
--at 233-238: hard, nodular, massive marly micrite..... 37.5'

16. Limestone: light brownish-gray, hard, dense, porcellaneous micrite; interval passes laterally into micrite breccia; upper boundary abrupt, even, with filled borings on north side of cut about 200 feet east of west end; oysters cemented to surface..... 3'

15. Limestone and travertine: yellowish-brown, massive, very porous and permeable, cherty, coarsely-crystalline, sucrosic limestone and travertine; some soft pockets of pulverulent limestone; scattered brown chert nodules; some collapse features are evident; very cavernous, reddish zone in top 2 feet..... 8'

14. Crystalline limestone, travertine, and pulverulent limestone: interbedded light- to medium-gray, coarse-crystalline limestone, light yellowish-brown, very soft, marly pulverulent limestone, medium-gray limestone collapse-breccia, and brown travertine; other features:
--at 165-168: grayish-brown, soft dolomitic marl
--at 170: marl streak pinches out
--at 179: abrupt contact
--at 179-181.5 and 188-198: soft, white pulverulent marly limestone..... 33'

13. Marl: very light-gray to white, soft, deeply-weathered, pulverulent argillaceous micrite; more fissile than nodular; abundant evidence of surface swelling and distortion; other features:
--at 150-157: mostly covered
--at 163-165: two thin beds of light-cream to yellowish-gray oyster biomicrite and and biosparite; upper bed with dark-brown chert nodules..... 16'

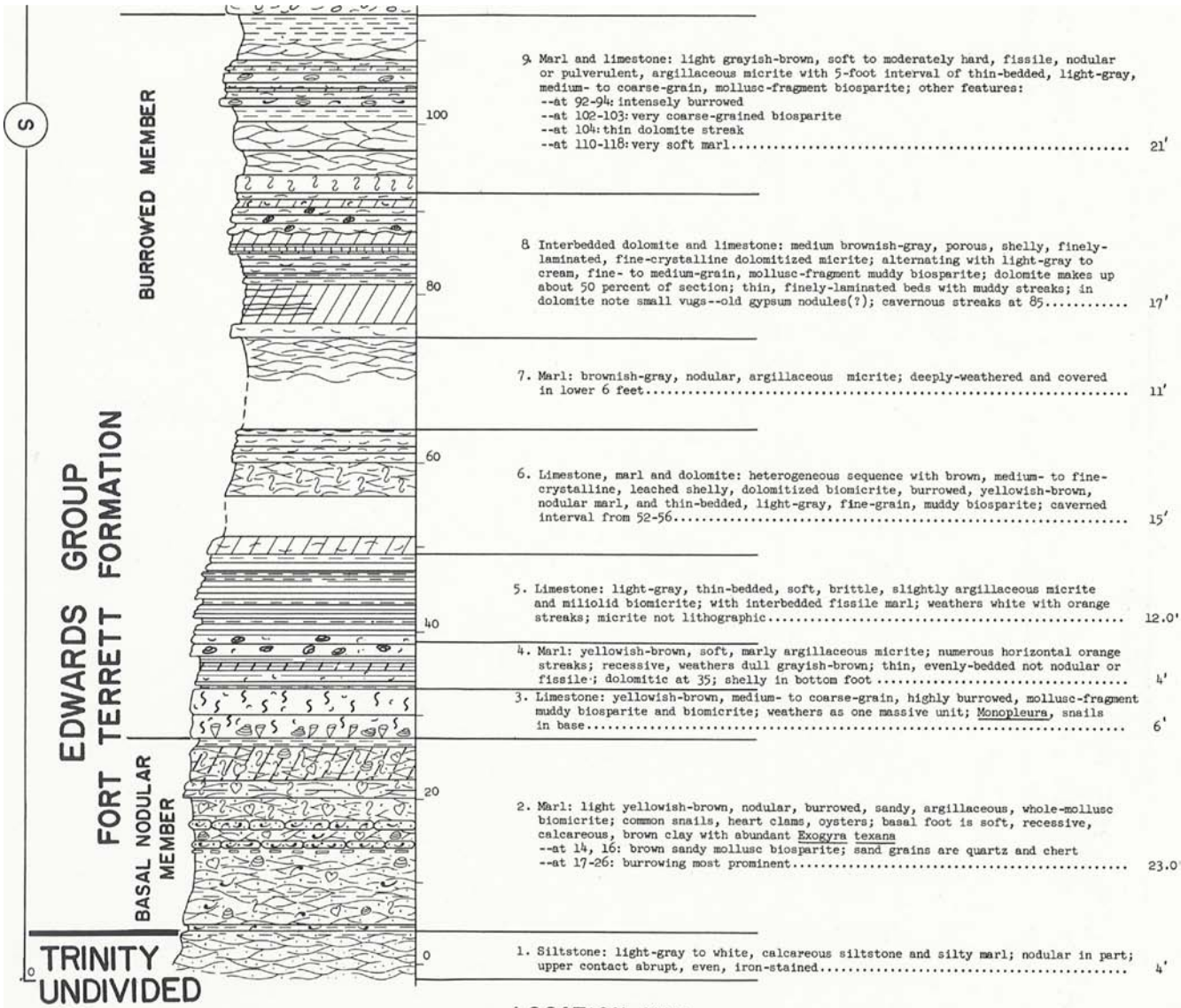
12. Limestone: light-gray to cream, fine- to very coarse-, poorly-sorted to well-sorted, porous, mollusc-fragment biosparite and intrasparite; scattered miliolids; other features:
--at 133: dark-gray chert nodules
--at 135: thin-bedded dolomite
--at 136-138: large intraclasts and shells
--at 143-146: marly interval..... 16.5'

11. Dolomite and marl: grayish-brown, homogeneous, fine-crystalline, burrowed, dolomitized micrite with very light-gray to white, soft, pulverulent, marly, argillaceous limestone..... 10'

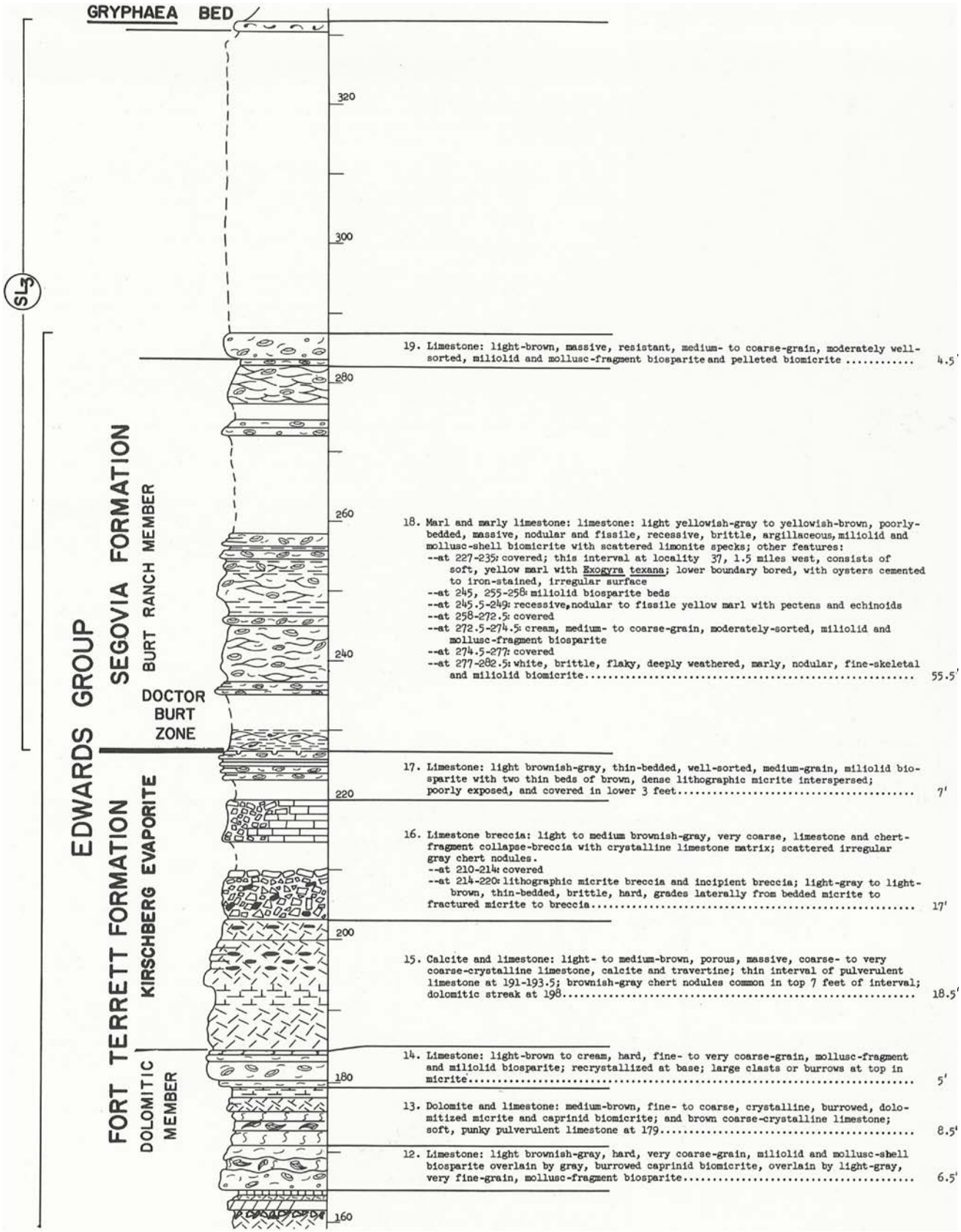
10. Dolomite: light grayish-brown, laminated, soft, porous, fine-crystalline, dolomitized micrite; gray chert nodules at 117; soft white nodular to fissile marl interbeds; coarse-grain, light-gray biosparite bed at base..... 9.5'

9. Marl and limestone: light grayish-brown, soft to moderately hard, fissile, nodular or pulverulent, argillaceous micrite with 5-foot interval of thin-bedded, light-gray, medium- to coarse-grain, mollusc-fragment biosparite; other features:
--at 92-94: intensely burrowed
--at 102-103: very coarse-grained biosparite
--at 104: thin dolomite streak
--at 110-118: very soft marl..... 21'

8. Interbedded dolomite and limestone: medium brownish-gray, porous, shelly, finely-laminated, fine-crystalline dolomitized micrite; alternating with light-gray to cream, fine- to medium-grain, mollusc-fragment muddy biosparite; dolomite makes up about 50 percent of section; thin, finely-laminated beds with muddy streaks; in dolomite note small vugs--old gypsum nodules(?); cavernous streaks at 85..... 17'


S
EDWARDS GROUP
FORT TERRETT FORMATION
BURROWED MEMBER
BASAL NODULAR MEMBER
TRINITY UNDIVIDED
100
80
60
40
20
0
9. Marl and limestone: light grayish-brown, soft to moderately hard, fissile, nodular or pulverulent, argillaceous micrite with 5-foot interval of thin-bedded, light-gray, medium- to coarse-grain, mollusc-fragment biosparite; other features:
--at 92-94: intensely burrowed
--at 102-103: very coarse-grained biosparite
--at 104: thin dolomite streak
--at 110-118: very soft marl..... 21'
8. Interbedded dolomite and limestone: medium brownish-gray, porous, shelly, finely-laminated, fine-crystalline dolomitized micrite; alternating with light-gray to cream, fine- to medium-grain, mollusc-fragment muddy biosparite; dolomite makes up about 50 percent of section; thin, finely-laminated beds with muddy streaks; in dolomite note small vugs--old gypsum nodules(?); cavernous streaks at 85..... 17'
7. Marl: brownish-gray, nodular, argillaceous micrite; deeply-weathered and covered in lower 6 feet..... 11'
6. Limestone, marl and dolomite: heterogeneous sequence with brown, medium- to fine-crystalline, leached shelly, dolomitized biomicrite, burrowed, yellowish-brown, nodular marl, and thin-bedded, light-gray, fine-grain, muddy biosparite; caverned interval from 52-56..... 15'
5. Limestone: light-gray, thin-bedded, soft, brittle, slightly argillaceous micrite and miliolid biomicrite; with interbedded fissile marl; weathers white with orange streaks; micrite not lithographic..... 12.0'
4. Marl: yellowish-brown, soft, marly argillaceous micrite; numerous horizontal orange streaks; recessive, weathers dull grayish-brown; thin, evenly-bedded not nodular or fissile; dolomitic at 35; shelly in bottom foot..... 4'
3. Limestone: yellowish-brown, medium- to coarse-grain, highly burrowed, mollusc-fragment muddy biosparite and biomicrite; weathers as one massive unit; Monopleura, snails in base..... 6'
2. Marl: light yellowish-brown, nodular, burrowed, sandy, argillaceous, whole-mollusc biomicrite; common snails, heart clams, oysters; basal foot is soft, recessive, calcareous, brown clay with abundant Exogyra texana
--at 14, 16: brown sandy mollusc biosparite; sand grains are quartz and chert
--at 17-26: burrowing most prominent..... 23.0'
1. Siltstone: light-gray to white, calcareous siltstone and silty marl; nodular in part; upper contact abrupt, even, iron-stained..... 4'
LOCATION MAP
Segovia
Ks
0
5 Miles
Underground
JC3
JC2
JC4
JC5
10
I
KIMBLE COUNTY
KERR COUNTY
290

SOUTH LLANO



19. Limestone: light-brown, massive, resistant, medium- to coarse-grain, moderately well-sorted, miliolid and mollusc-fragment biosparite and pelleted biomicrite ..... 4.5'

18. Marl and marly limestone: limestone: light yellowish-gray to yellowish-brown, poorly-bedded, massive, nodular and fissile, recessive, brittle, argillaceous, miliolid and mollusc-shell biomicrite with scattered limonite specks; other features:
--at 227-235: covered; this interval at locality 37, 1.5 miles west, consists of soft, yellow marl with Exogyra texana; lower boundary bored, with oysters cemented to iron-stained, irregular surface
--at 245, 255-258: miliolid biosparite beds
--at 245.5-249: recessive, nodular to fissile yellow marl with pectens and echinoids
--at 258-272.5: covered
--at 272.5-274.5: cream, medium- to coarse-grain, moderately-sorted, miliolid and mollusc-fragment biosparite
--at 274.5-277: covered
--at 277-282.5: white, brittle, flaky, deeply weathered, marly, nodular, fine-skeletal and miliolid biomicrite..... 55.5'

17. Limestone: light brownish-gray, thin-bedded, well-sorted, medium-grain, miliolid biosparite with two thin beds of brown, dense lithographic micrite interspersed; poorly exposed, and covered in lower 3 feet..... 7'

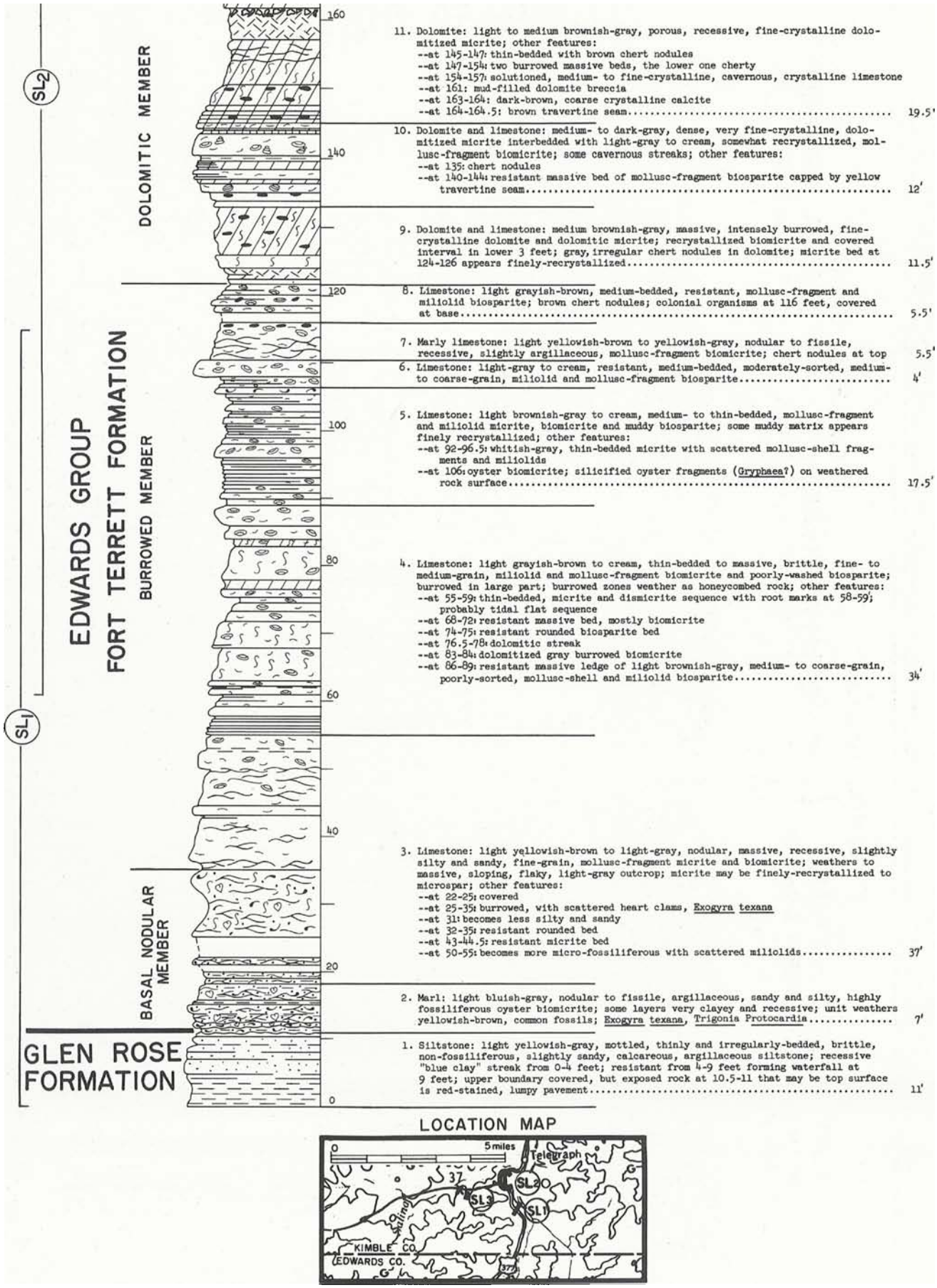
16. Limestone breccia: light to medium brownish-gray, very coarse, limestone and chert-fragment collapse-breccia with crystalline limestone matrix; scattered irregular gray chert nodules.
--at 210-214: covered
--at 214-220: lithographic micrite breccia and incipient breccia; light-gray to light-brown, thin-bedded, brittle, hard, grades laterally from bedded micrite to fractured micrite to breccia..... 17'

15. Calcite and limestone: light- to medium-brown, porous, massive, coarse- to very coarse-crystalline limestone, calcite and travertine; thin interval of pulverulent limestone at 191-193.5; brownish-gray chert nodules common in top 7 feet of interval; dolomitic streak at 198..... 18.5'

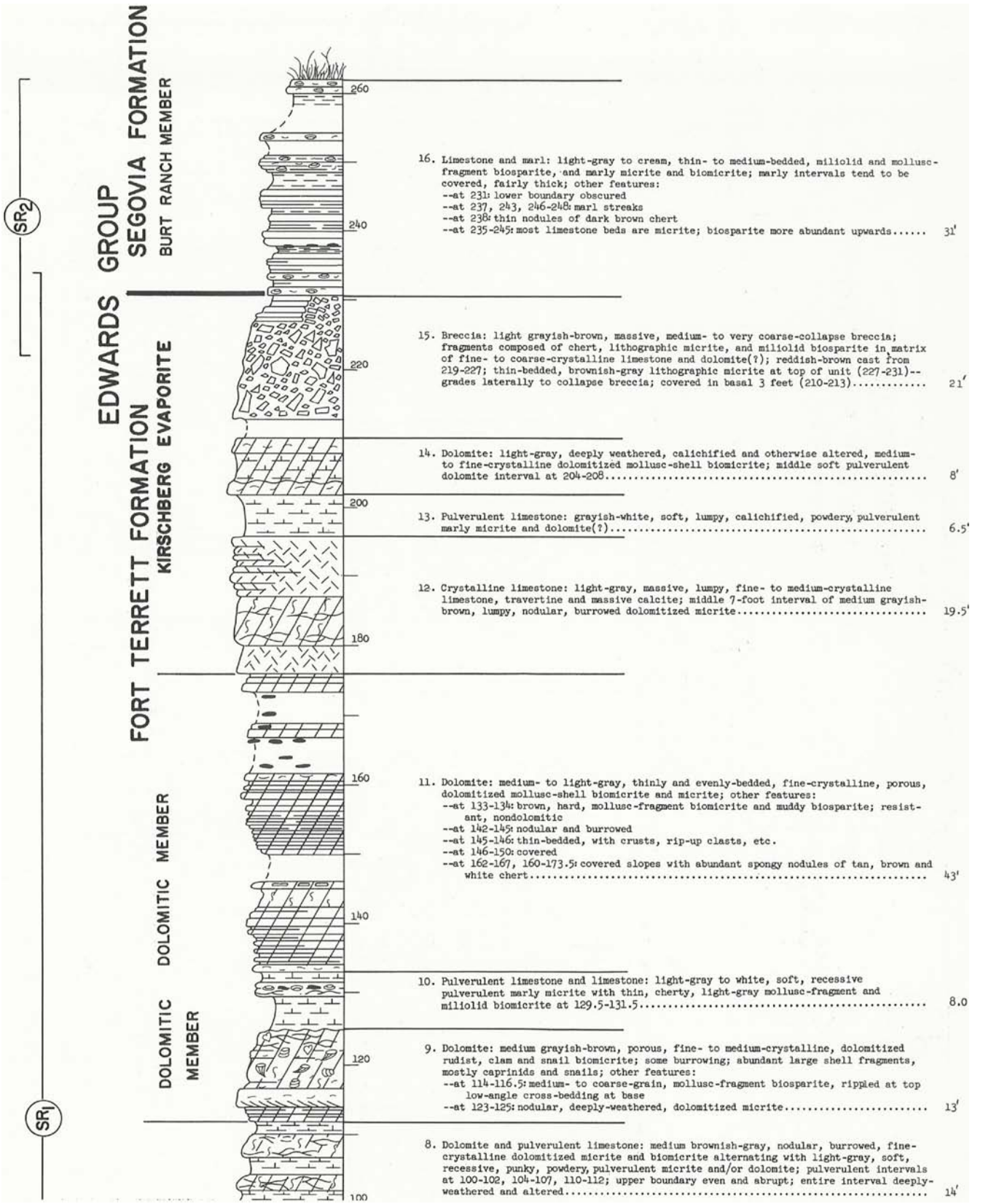
14. Limestone: light-brown to cream, hard, fine- to very coarse-grain, mollusc-fragment and miliolid biosparite; recrystallized at base; large clasts or burrows at top in micrite..... 5'

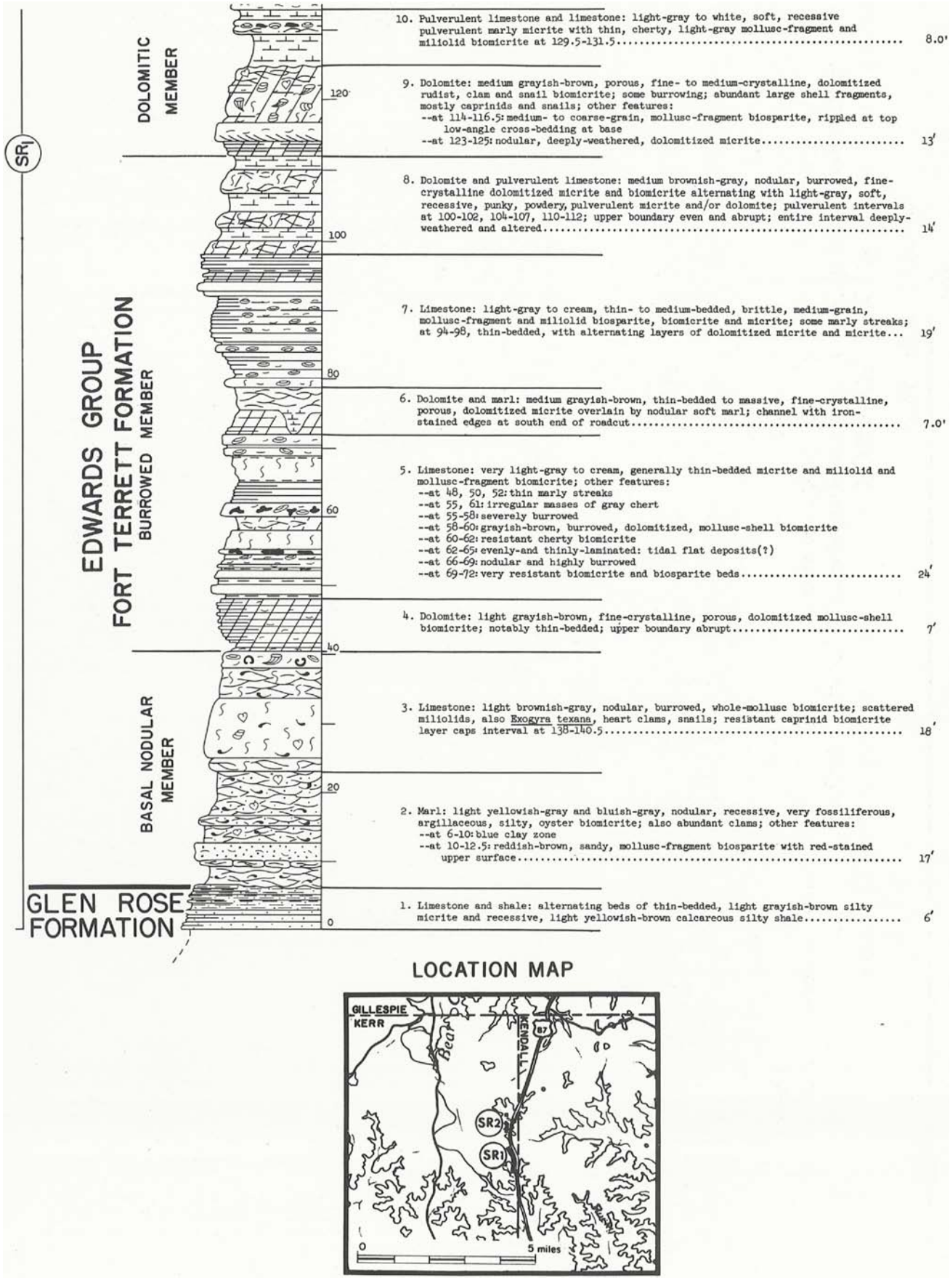
13. Dolomite and limestone: medium-brown, fine- to coarse, crystalline, burrowed, dolomitized micrite and caprinid biomicrite; and brown coarse-crystalline limestone; soft, punky pulverulent limestone at 179..... 8.5'

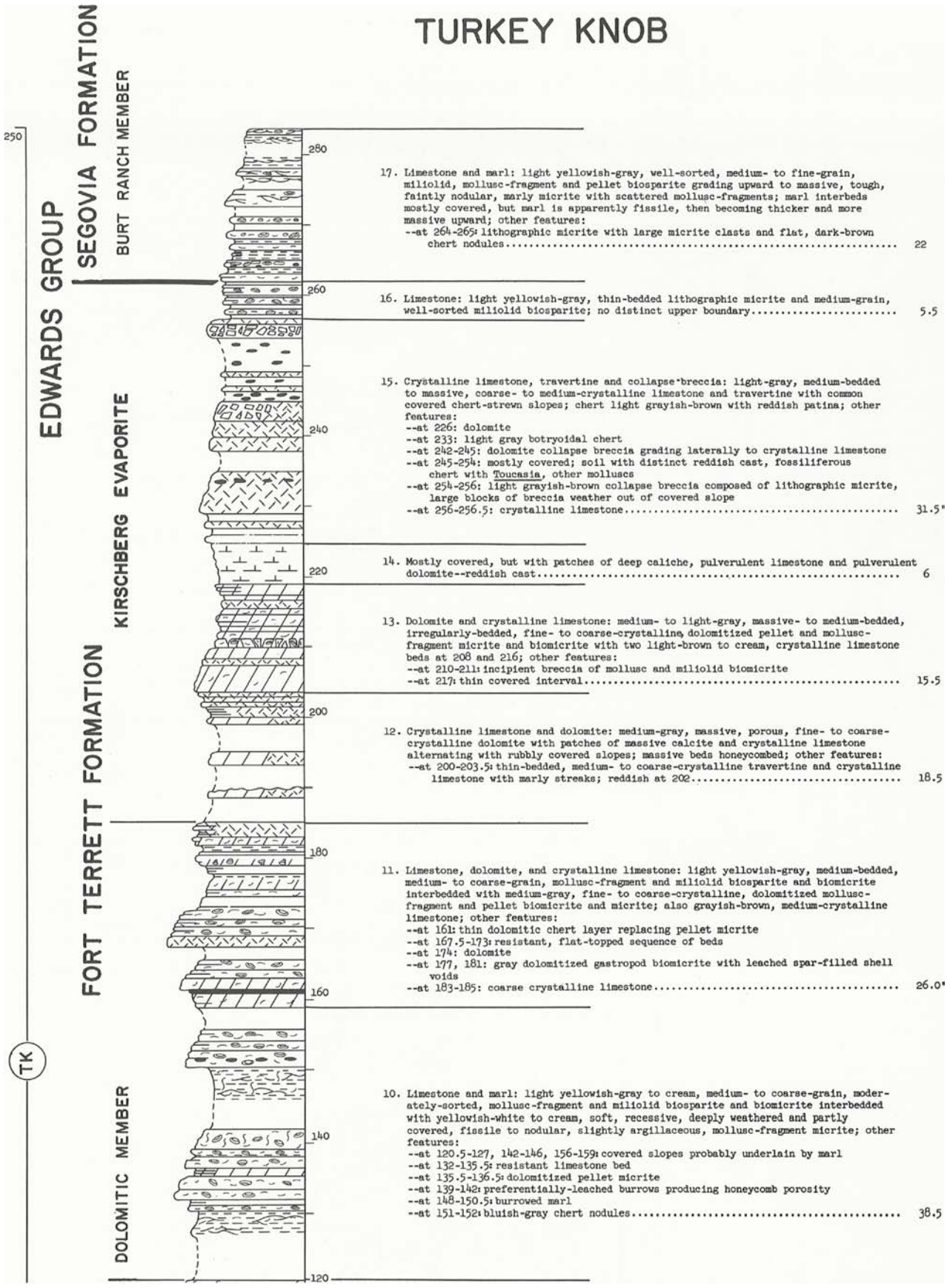
12. Limestone: light brownish-gray, hard, very coarse-grain, miliolid and mollusc-shell biosparite overlain by gray, burrowed caprinid biomicrite, overlain by light-gray, very fine-grain, mollusc-fragment biosparite..... 6.5'

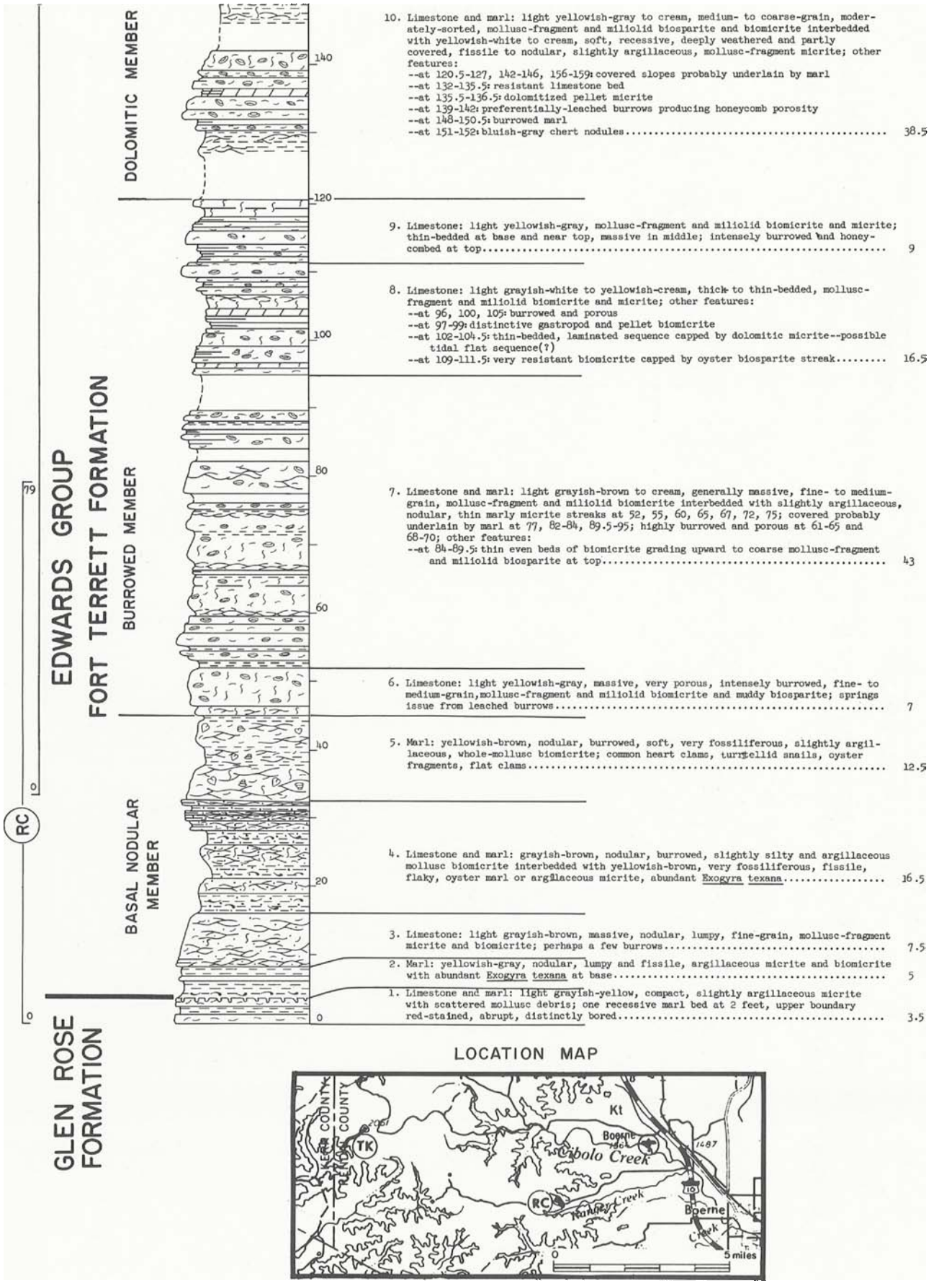

SL2
SL1
EDWARDS GROUP
FORT TERRETT FORMATION
DOLOMITIC MEMBER
BURROWED MEMBER
BASAL NODULAR MEMBER
GLEN ROSE FORMATION
160
140
120
100
80
60
40
20
0
11. Dolomite: light to medium brownish-gray, porous, recessive, fine-crystalline dolomitized micrite; other features:
--at 145-147: thin-bedded with brown chert nodules
--at 147-154: two burrowed massive beds, the lower one cherty
--at 154-157: solutioned, medium- to fine-crystalline, cavernous, crystalline limestone
--at 161: mud-filled dolomite breccia
--at 163-164: dark-brown, coarse crystalline calcite
--at 164-164.5: brown travertine seam..... 19.5'
10. Dolomite and limestone: medium- to dark-gray, dense, very fine-crystalline, dolomitized micrite interbedded with light-gray to cream, somewhat recrystallized, mollusc-fragment biomicrite; some cavernous streaks; other features:
--at 135: chert nodules
--at 140-144: resistant massive bed of mollusc-fragment biosparite capped by yellow travertine seam..... 12'
9. Dolomite and limestone: medium brownish-gray, massive, intensely burrowed, fine-crystalline dolomite and dolomitic micrite; recrystallized biomicrite and covered interval in lower 3 feet; gray, irregular chert nodules in dolomite; micrite bed at 124-126 appears finely-recrystallized..... 11.5'
8. Limestone: light grayish-brown, medium-bedded, resistant, mollusc-fragment and miliolid biosparite; brown chert nodules; colonial organisms at 116 feet, covered at base..... 5.5'
7. Marly limestone: light yellowish-brown to yellowish-gray, nodular to fissile, recessive, slightly argillaceous, mollusc-fragment biomicrite; chert nodules at top 5.5'
6. Limestone: light-gray to cream, resistant, medium-bedded, moderately-sorted, medium- to coarse-grain, miliolid and mollusc-fragment biosparite..... 4'
5. Limestone: light brownish-gray to cream, medium- to thin-bedded, mollusc-fragment and miliolid micrite, biomicrite and muddy biosparite; some muddy matrix appears finely recrystallized; other features:
--at 92-96.5: whitish-gray, thin-bedded micrite with scattered mollusc-shell fragments and miliolids
--at 106: oyster biomicrite; silicified oyster fragments (Gryphaea?) on weathered rock surface..... 17.5'
4. Limestone: light grayish-brown to cream, thin-bedded to massive, brittle, fine- to medium-grain, miliolid and mollusc-fragment biomicrite and poorly-washed biosparite; burrowed in large part; burrowed zones weather as honeycombed rock; other features:
--at 55-59: thin-bedded, micrite and dismicrite sequence with root marks at 58-59; probably tidal flat sequence
--at 68-72: resistant massive bed, mostly biomicrite
--at 74-75: resistant rounded biosparite bed
--at 76.5-78: dolomitic streak
--at 83-84: dolomitized gray burrowed biomicrite
--at 86-89: resistant massive ledge of light brownish-gray, medium- to coarse-grain, poorly-sorted, mollusc-shell and miliolid biosparite..... 34'
3. Limestone: light yellowish-brown to light-gray, nodular, massive, recessive, slightly silty and sandy, fine-grain, mollusc-fragment micrite and biomicrite; weathers to massive, sloping, flaky, light-gray outcrop; micrite may be finely-recrystallized to microspar; other features:
--at 22-25: covered
--at 25-35: burrowed, with scattered heart clams, Exogyra texana
--at 31: becomes less silty and sandy
--at 32-35: resistant rounded bed
--at 43-44.5: resistant micrite bed
--at 50-55: becomes more micro-fossiliferous with scattered miliolids..... 37'
2. Marl: light bluish-gray, nodular to fissile, argillaceous, sandy and silty, highly fossiliferous oyster biomicrite; some layers very clayey and recessive; unit weathers yellowish-brown, common fossils; Exogyra texana, Trigonia Protocardia..... 7'
1. Siltstone: light yellowish-gray, mottled, thinly and irregularly-bedded, brittle, non-fossiliferous, slightly sandy, calcareous, argillaceous siltstone; recessive "blue clay" streak from 0-4 feet; resistant from 4-9 feet forming waterfall at 9 feet; upper boundary covered, but exposed rock at 10.5-11 that may be top surface is red-stained, lumpy pavement..... 11'
LOCATION MAP
0
5 miles
Telegraph
37
SL2
SL3
SL1
KIMBLE CO.
EDWARDS CO.
377

STIELER RANCH

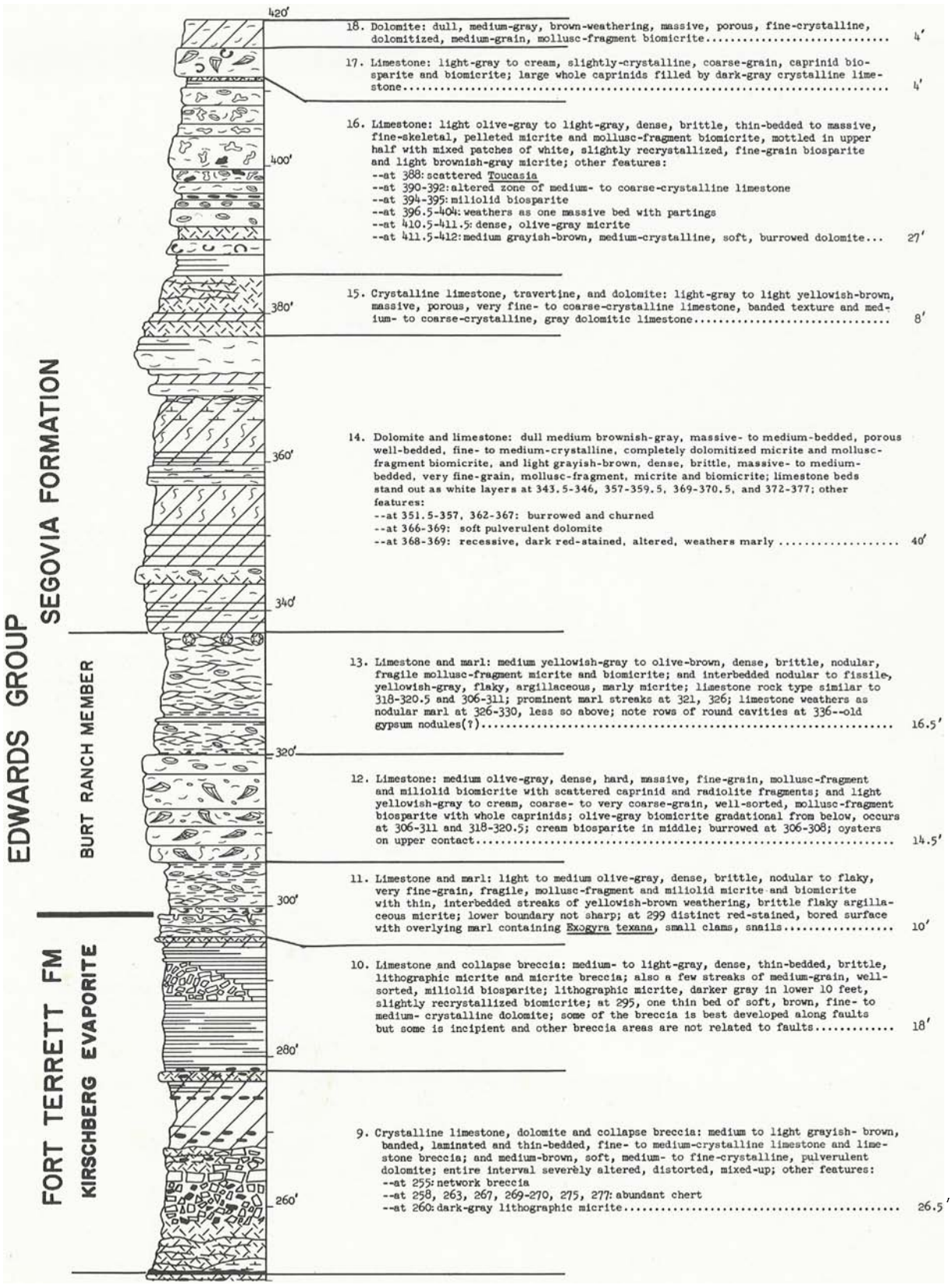



SR1
DOLOMITIC MEMBER
EDWARDS GROUP
FORT TERRETT FORMATION
BURROWED MEMBER
BASAL NODULAR MEMBER
GLEN ROSE FORMATION
120
100
80
60
40
20
0
10. Pulverulent limestone and limestone: light-gray to white, soft, recessive pulverulent marly micrite with thin, cherty, light-gray mollusc-fragment and miliolid biomicrite at 129.5-131.5 ..... 8.0'
9. Dolomite: medium grayish-brown, porous, fine- to medium-crystalline, dolomitized rudist, clam and snail biomicrite; some burrowing; abundant large shell fragments, mostly caprinids and snails; other features:
--at 114-116.5: medium- to coarse-grain, mollusc-fragment biosparite, rippled at top low-angle cross-bedding at base
--at 123-125: nodular, deeply-weathered, dolomitized micrite ..... 13'
8. Dolomite and pulverulent limestone: medium brownish-gray, nodular, burrowed, fine-crystalline dolomitized micrite and biomicrite alternating with light-gray, soft, recessive, punky, powdery, pulverulent micrite and/or dolomite; pulverulent intervals at 100-102, 104-107, 110-112; upper boundary even and abrupt; entire interval deeply-weathered and altered ..... 14'
7. Limestone: light-gray to cream, thin- to medium-bedded, brittle, medium-grain, mollusc-fragment and miliolid biosparite, biomicrite and micrite; some marly streaks; at 94-98, thin-bedded, with alternating layers of dolomitized micrite and micrite... 19'
6. Dolomite and marl: medium grayish-brown, thin-bedded to massive, fine-crystalline, porous, dolomitized micrite overlain by nodular soft marl; channel with iron-stained edges at south end of roadcut ..... 7.0'
5. Limestone: very light-gray to cream, generally thin-bedded micrite and miliolid and mollusc-fragment biomicrite; other features:
--at 48, 50, 52: thin marly streaks
--at 55, 61: irregular masses of gray chert
--at 55-58: severely burrowed
--at 58-60: grayish-brown, burrowed, dolomitized, mollusc-shell biomicrite
--at 60-62: resistant cherty biomicrite
--at 62-65: evenly-and thinly-laminated: tidal flat deposits(?)
--at 66-69: nodular and highly burrowed
--at 69-72: very resistant biomicrite and biosparite beds ..... 24'
4. Dolomite: light grayish-brown, fine-crystalline, porous, dolomitized mollusc-shell biomicrite; notably thin-bedded; upper boundary abrupt ..... 7'
3. Limestone: light brownish-gray, nodular, burrowed, whole-mollusc biomicrite; scattered miliolids, also Exogyra texana, heart clams, snails; resistant caprinid biomicrite layer caps interval at 138-140.5 ..... 18'
2. Marl: light yellowish-gray and bluish-gray, nodular, recessive, very fossiliferous, argillaceous, silty, oyster biomicrite; also abundant clams; other features:
--at 6-10: blue clay zone
--at 10-12.5: reddish-brown, sandy, mollusc-fragment biosparite with red-stained upper surface ..... 17'
1. Limestone and shale: alternating beds of thin-bedded, light grayish-brown silty micrite and recessive, light yellowish-brown calcareous silty shale ..... 6'
LOCATION MAP
GILLESPIE
KERR
Bear
KENDALL
87
SR2
SR1
0
5 miles


TURKEY KNOB
EDWARDS GROUP
SEGOVIA FORMATION
BURT RANCH MEMBER
KIRSCHBERG EVAPORITE
FORT TERRETT FORMATION
DOLOMITIC MEMBER
TK
250
280
260
240
220
200
180
160
140
120
17. Limestone and marl: light yellowish-gray, well-sorted, medium- to fine-grain, miliolid, mollusc-fragment and pellet biosparite grading upward to massive, tough, faintly nodular, marly micrite with scattered mollusc-fragments; marl interbeds mostly covered, but marl is apparently fissile, then becoming thicker and more massive upward; other features:
--at 264-265: lithographic micrite with large micrite clasts and flat, dark-brown chert nodules..... 22
16. Limestone: light yellowish-gray, thin-bedded lithographic micrite and medium-grain, well-sorted miliolid biosparite; no distinct upper boundary..... 5.5
15. Crystalline limestone, travertine and collapse-breccia: light-gray, medium-bedded to massive, coarse- to medium-crystalline limestone and travertine with common covered chert-strewn slopes; chert light grayish-brown with reddish patina; other features:
--at 226: dolomite
--at 233: light gray botryoidal chert
--at 242-245: dolomite collapse breccia grading laterally to crystalline limestone
--at 245-254: mostly covered; soil with distinct reddish cast, fossiliferous chert with Toucasia, other molluscs
--at 254-256: light grayish-brown collapse breccia composed of lithographic micrite, large blocks of breccia weather out of covered slope
--at 256-256.5: crystalline limestone..... 31.5'
14. Mostly covered, but with patches of deep caliche, pulverulent limestone and pulverulent dolomite--reddish cast..... 6
13. Dolomite and crystalline limestone: medium- to light-gray, massive- to medium-bedded, irregularly-bedded, fine- to coarse-crystalline, dolomitized pellet and mollusc-fragment micrite and biomicrite with two light-brown to cream, crystalline limestone beds at 208 and 216; other features:
--at 210-211: incipient breccia of mollusc and miliolid biomicrite
--at 217: thin covered interval..... 15.5
12. Crystalline limestone and dolomite: medium-gray, massive, porous, fine- to coarse-crystalline dolomite with patches of massive calcite and crystalline limestone alternating with rubbly covered slopes; massive beds honeycombed; other features:
--at 200-203.5: thin-bedded, medium- to coarse-crystalline travertine and crystalline limestone with marly streaks; reddish at 202..... 18.5
11. Limestone, dolomite, and crystalline limestone: light yellowish-gray, medium-bedded, medium- to coarse-grain, mollusc-fragment and miliolid biosparite and biomicrite interbedded with medium-gray, fine- to coarse-crystalline, dolomitized mollusc-fragment and pellet biomicrite and micrite; also grayish-brown, medium-crystalline limestone; other features:
--at 161: thin dolomitic chert layer replacing pellet micrite
--at 167.5-173: resistant, flat-topped sequence of beds
--at 174: dolomite
--at 177, 181: gray dolomitized gastropod biomicrite with leached spar-filled shell voids
--at 183-185: coarse crystalline limestone..... 26.0'
10. Limestone and marl: light yellowish-gray to cream, medium- to coarse-grain, moderately-sorted, mollusc-fragment and miliolid biosparite and biomicrite interbedded with yellowish-white to cream, soft, recessive, deeply weathered and partly covered, fissile to nodular, slightly argillaceous, mollusc-fragment micrite; other features:
--at 120.5-127, 142-146, 156-159: covered slopes probably underlain by marl
--at 132-135.5: resistant limestone bed
--at 135.5-136.5: dolomitized pellet micrite
--at 139-142: preferentially-leached burrows producing honeycomb porosity
--at 148-150.5: burrowed marl
--at 151-152: bluish-gray chert nodules..... 38.5


EDWARDS GROUP
FORT TERRETT FORMATION
DOLOMITIC MEMBER
BURROWED MEMBER
BASAL NODULAR MEMBER
GLEN ROSE FORMATION
RC
79
0
140
120
100
80
60
40
20
0
10. Limestone and marl: light yellowish-gray to cream, medium- to coarse-grain, moderately-sorted, mollusc-fragment and miliolid biosparite and biomicrite interbedded with yellowish-white to cream, soft, recessive, deeply weathered and partly covered, fissile to nodular, slightly argillaceous, mollusc-fragment micrite; other features:
--at 120.5-127, 142-146, 156-159: covered slopes probably underlain by marl
--at 132-135.5: resistant limestone bed
--at 135.5-136.5: dolomitized pellet micrite
--at 139-142: preferentially-leached burrows producing honeycomb porosity
--at 148-150.5: burrowed marl
--at 151-152: bluish-gray chert nodules 38.5
9. Limestone: light yellowish-gray, mollusc-fragment and miliolid biomicrite and micrite; thin-bedded at base and near top, massive in middle; intensely burrowed and honeycombed at top 9
8. Limestone: light grayish-white to yellowish-cream, thick- to thin-bedded, mollusc-fragment and miliolid biomicrite and micrite; other features:
--at 96, 100, 105: burrowed and porous
--at 97-99: distinctive gastropod and pellet biomicrite
--at 102-104.5: thin-bedded, laminated sequence capped by dolomitic micrite--possible tidal flat sequence(?)
--at 109-111.5: very resistant biomicrite capped by oyster biosparite streak 16.5
7. Limestone and marl: light grayish-brown to cream, generally massive, fine- to medium-grain, mollusc-fragment and miliolid biomicrite interbedded with slightly argillaceous, nodular, thin marly micrite streaks at 52, 55, 60, 65, 67, 72, 75; covered probably underlain by marl at 77, 82-84, 89.5-95; highly burrowed and porous at 61-65 and 68-70; other features:
--at 84-89.5: thin even beds of biomicrite grading upward to coarse mollusc-fragment and miliolid biosparite at top 43
6. Limestone: light yellowish-gray, massive, very porous, intensely burrowed, fine- to medium-grain, mollusc-fragment and miliolid biomicrite and muddy biosparite; springs issue from leached burrows 7
5. Marl: yellowish-brown, nodular, burrowed, soft, very fossiliferous, slightly argillaceous, whole-mollusc biomicrite; common heart clams, turritellid snails, oyster fragments, flat clams 12.5
4. Limestone and marl: grayish-brown, nodular, burrowed, slightly silty and argillaceous mollusc biomicrite interbedded with yellowish-brown, very fossiliferous, fissile, flaky, oyster marl or argillaceous micrite, abundant Exogyra texana 16.5
3. Limestone: light grayish-brown, massive, nodular, lumpy, fine-grain, mollusc-fragment micrite and biomicrite; perhaps a few burrows 7.5
2. Marl: yellowish-gray, nodular, lumpy and fissile, argillaceous micrite and biomicrite with abundant Exogyra texana at base 5
1. Limestone and marl: light grayish-yellow, compact, slightly argillaceous micrite with scattered mollusc debris; one recessive marl bed at 2 feet, upper boundary red-stained, abrupt, distinctly bored 3.5
LOCATION MAP
COMAL COUNTY
KENDALL COUNTY
TK
RC
Kt
Boerne
1487
Cibolo Creek
Menger Creek
10
Boerne
Creek
0
5 miles

VANDERPOOL



18. Dolomite: dull, medium-gray, brown-weathering, massive, porous, fine-crystalline, dolomitized, medium-grain, mollusc-fragment biomicrite..... 4'

17. Limestone: light-gray to cream, slightly-crystalline, coarse-grain, caprinid biosparite and biomicrite; large whole caprinids filled by dark-gray crystalline limestone..... 4'

16. Limestone: light olive-gray to light-gray, dense, brittle, thin-bedded to massive, fine-skeletal, pelleted micrite and mollusc-fragment biomicrite, mottled in upper half with mixed patches of white, slightly recrystallized, fine-grain biosparite and light brownish-gray micrite; other features:
--at 388: scattered Toucasia
--at 390-392: altered zone of medium- to coarse-crystalline limestone
--at 394-395: miliolid biosparite
--at 396.5-404: weathers as one massive bed with partings
--at 410.5-411.5: dense, olive-gray micrite
--at 411.5-412: medium grayish-brown, medium-crystalline, soft, burrowed dolomite... 27'

15. Crystalline limestone, travertine, and dolomite: light-gray to light yellowish-brown, massive, porous, very fine- to coarse-crystalline limestone, banded texture and medium- to coarse-crystalline, gray dolomitic limestone..... 8'

14. Dolomite and limestone: dull medium brownish-gray, massive- to medium-bedded, porous well-bedded, fine- to medium-crystalline, completely dolomitized micrite and mollusc-fragment biomicrite, and light grayish-brown, dense, brittle, massive- to medium-bedded, very fine-grain, mollusc-fragment, micrite and biomicrite; limestone beds stand out as white layers at 343.5-346, 357-359.5, 369-370.5, and 372-377; other features:
--at 351.5-357, 362-367: burrowed and churned
--at 366-369: soft pulverulent dolomite
--at 368-369: recessive, dark red-stained, altered, weathers marly ..... 40'

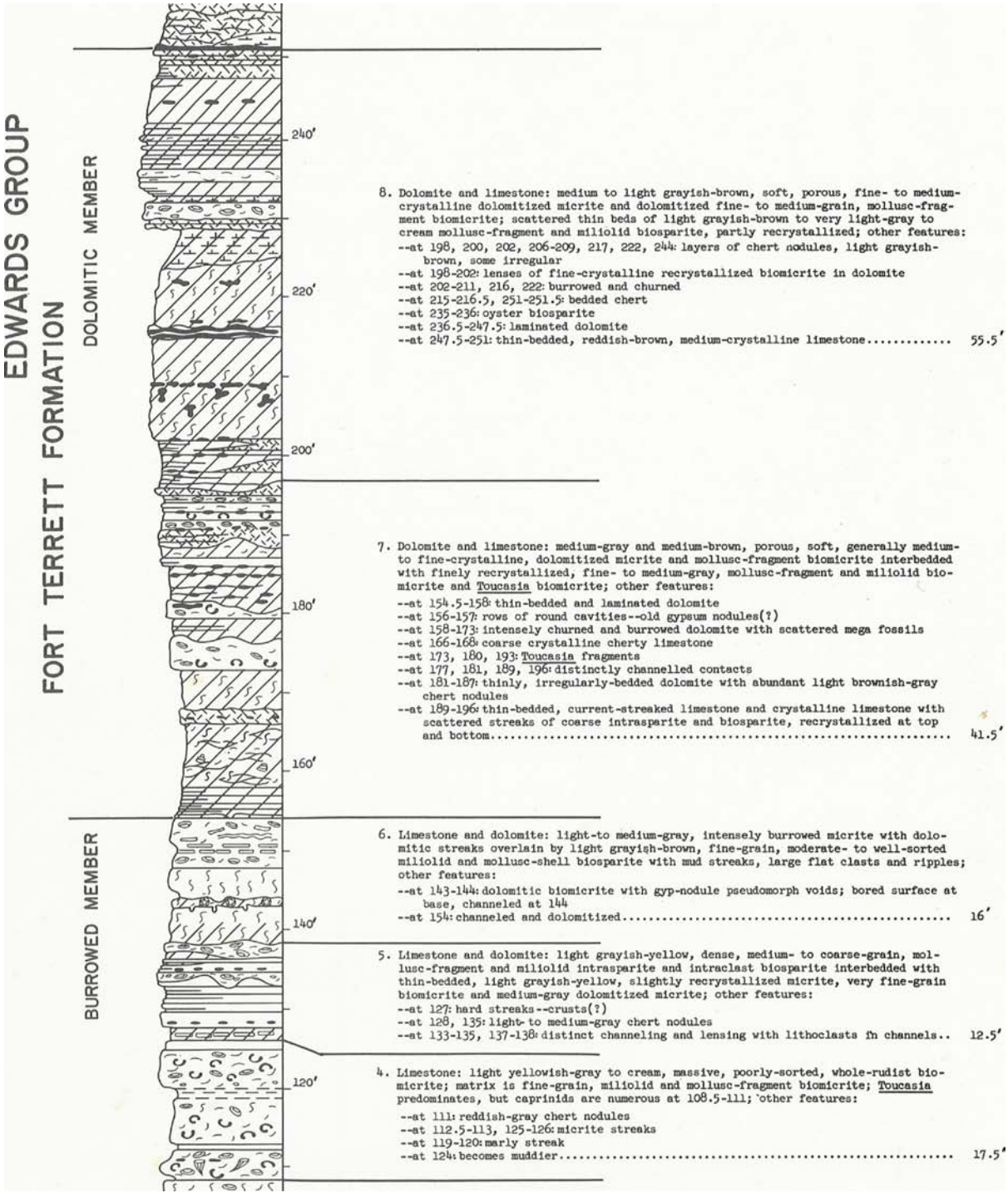
13. Limestone and marl: medium yellowish-gray to olive-brown, dense, brittle, nodular, fragile mollusc-fragment micrite and biomicrite; and interbedded nodular to fissile, yellowish-gray, flaky, argillaceous, marly micrite; limestone rock type similar to 318-320.5 and 306-311; prominent marl streaks at 321, 326; limestone weathers as nodular marl at 326-330, less so above; note rows of round cavities at 336--old gypsum nodules(?)..... 16.5'

12. Limestone: medium olive-gray, dense, hard, massive, fine-grain, mollusc-fragment and miliolid biomicrite with scattered caprinid and radiolite fragments; and light yellowish-gray to cream, coarse- to very coarse-grain, well-sorted, mollusc-fragment biosparite with whole caprinids; olive-gray biomicrite gradational from below, occurs at 306-311 and 318-320.5; cream biosparite in middle; burrowed at 306-308; oysters on upper contact..... 14.5'

11. Limestone and marl: light to medium olive-gray, dense, brittle, nodular to flaky, very fine-grain, fragile, mollusc-fragment and miliolid micrite and biomicrite with thin, interbedded streaks of yellowish-brown weathering, brittle flaky argillaceous micrite; lower boundary not sharp; at 299 distinct red-stained, bored surface with overlying marl containing Exogyra texana, small clams, snails..... 10'

10. Limestone and collapse breccia: medium- to light-gray, dense, thin-bedded, brittle, lithographic micrite and micrite breccia; also a few streaks of medium-grain, well-sorted, miliolid biosparite; lithographic micrite, darker gray in lower 10 feet, slightly recrystallized biomicrite; at 295, one thin bed of soft, brown, fine- to medium- crystalline dolomite; some of the breccia is best developed along faults but some is incipient and other breccia areas are not related to faults..... 18'

9. Crystalline limestone, dolomite and collapse breccia: medium to light grayish- brown, banded, laminated and thin-bedded, fine- to medium-crystalline limestone and limestone breccia; and medium-brown, soft, medium- to fine-crystalline, pulverulent dolomite; entire interval severely altered, distorted, mixed-up; other features:
--at 255: network breccia
--at 258, 263, 267, 269-270, 275, 277: abundant chert
--at 260: dark-gray lithographic micrite..... 26.5'



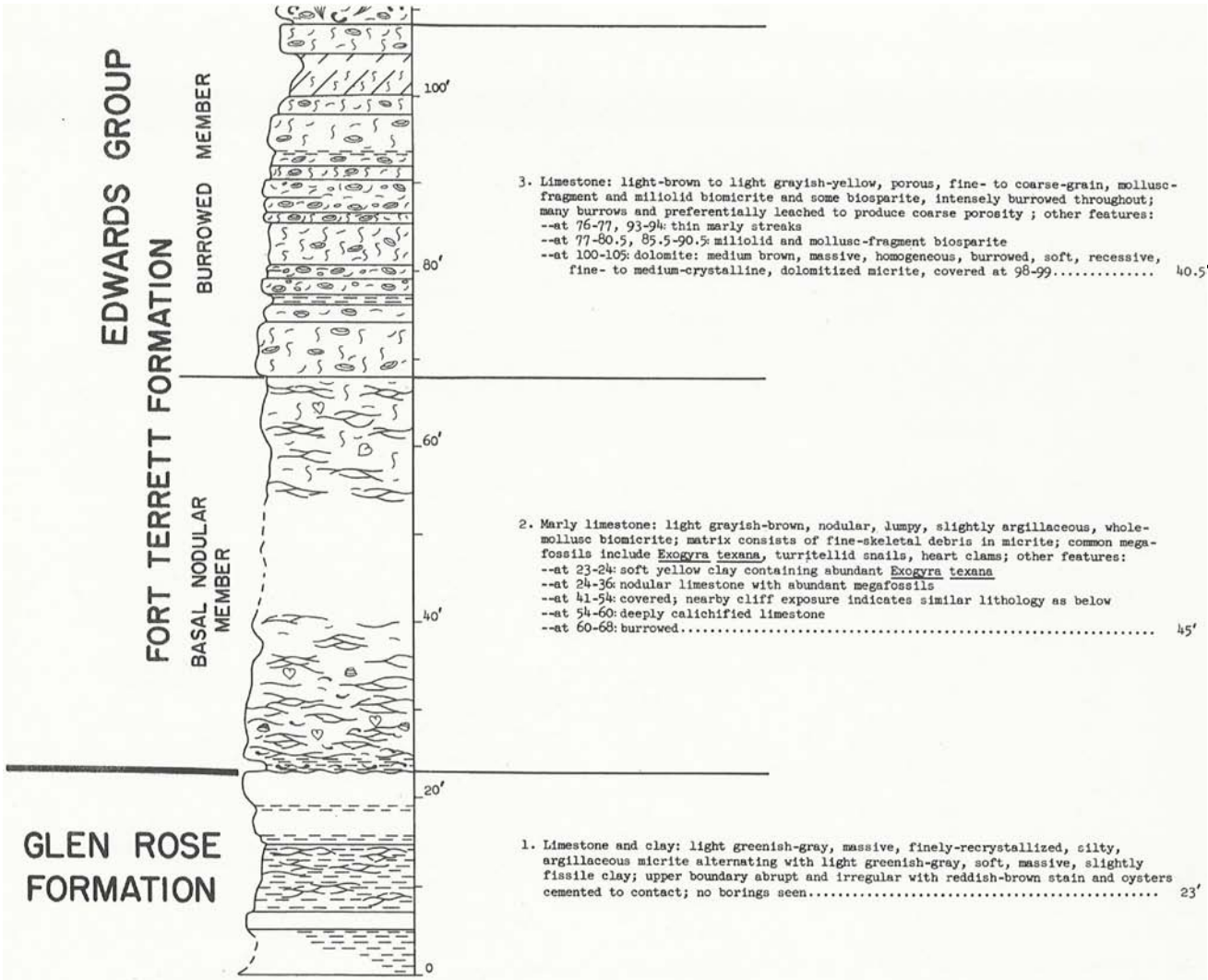
8. Dolomite and limestone: medium to light grayish-brown, soft, porous, fine- to medium-crystalline dolomitized micrite and dolomitized fine- to medium-grain, mollusc-fragment biomicrite; scattered thin beds of light grayish-brown to very light-gray to cream mollusc-fragment and miliolid biosparite, partly recrystallized; other features:
--at 198, 200, 202, 206-209, 217, 222, 244: layers of chert nodules, light grayish-brown, some irregular
--at 198-202: lenses of fine-crystalline recrystallized biomicrite in dolomite
--at 202-211, 216, 222: burrowed and churned
--at 215-216.5, 251-251.5: bedded chert
--at 235-236: oyster biosparite
--at 236.5-247.5: laminated dolomite
--at 247.5-251: thin-bedded, reddish-brown, medium-crystalline limestone..... 55.5'

7. Dolomite and limestone: medium-gray and medium-brown, porous, soft, generally medium- to fine-crystalline, dolomitized micrite and mollusc-fragment biomicrite interbedded with finely recrystallized, fine- to medium-gray, mollusc-fragment and miliolid biomicrite and Toucasia biomicrite; other features:
--at 154.5-158: thin-bedded and laminated dolomite
--at 156-157: rows of round cavities--old gypsum nodules(?)
--at 158-173: intensely churned and burrowed dolomite with scattered mega fossils
--at 166-168: coarse crystalline cherty limestone
--at 173, 180, 193: Toucasia fragments
--at 177, 181, 189, 196: distinctly channelled contacts
--at 181-187: thinly, irregularly-bedded dolomite with abundant light brownish-gray chert nodules
--at 189-196: thin-bedded, current-streaked limestone and crystalline limestone with scattered streaks of coarse intrasparite and biosparite, recrystallized at top and bottom..... 41.5'

6. Limestone and dolomite: light-to medium-gray, intensely burrowed micrite with dolomitic streaks overlain by light grayish-brown, fine-grain, moderate- to well-sorted miliolid and mollusc-shell biosparite with mud streaks, large flat clasts and ripples; other features:
--at 143-144: dolomitic biomicrite with gyp-nodule pseudomorph voids; bored surface at base, channeled at 144
--at 154: channeled and dolomitized..... 16'

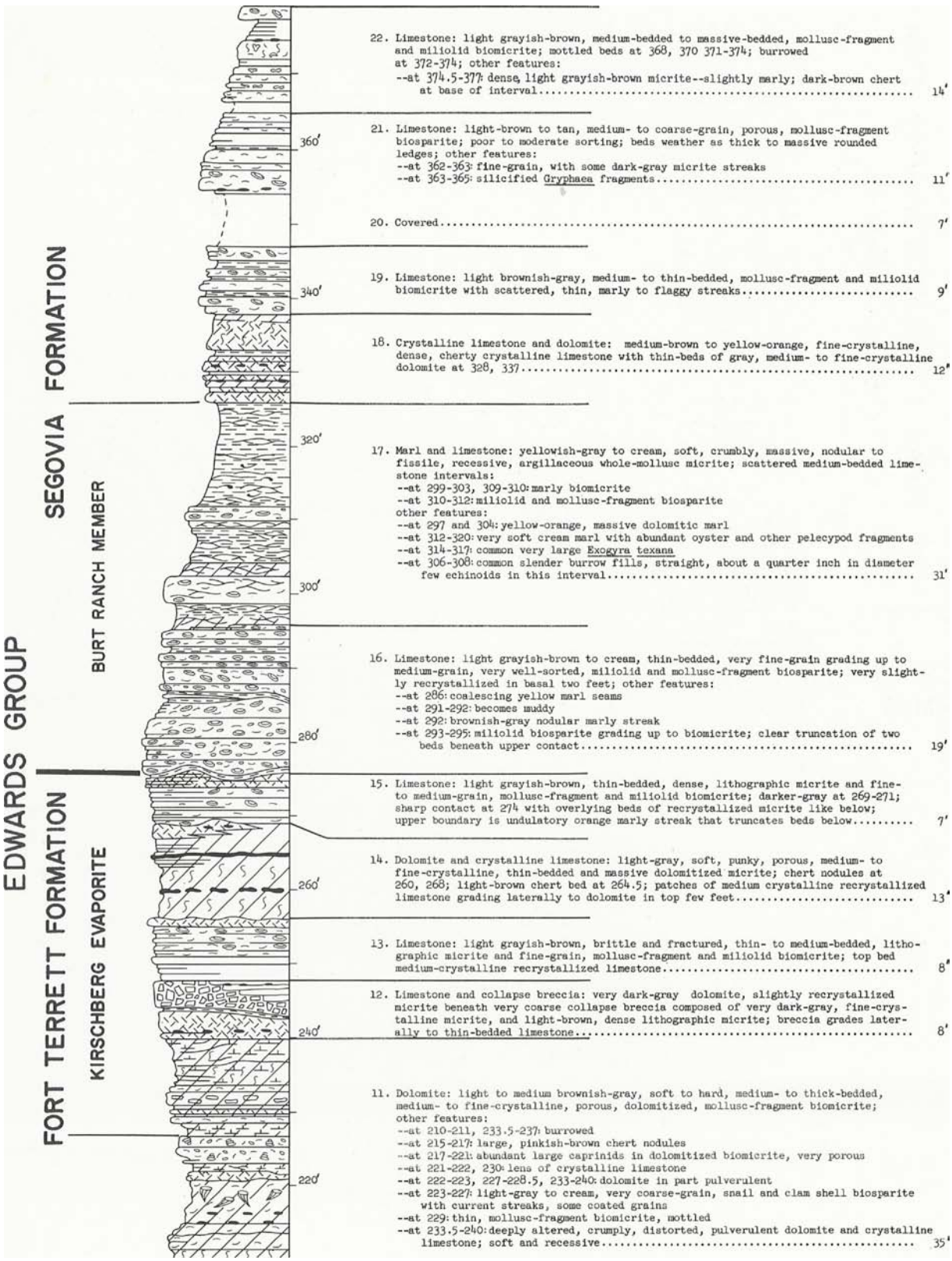
5. Limestone and dolomite: light grayish-yellow, dense, medium- to coarse-grain, mollusc-fragment and miliolid intrasparite and intraclast biosparite interbedded with thin-bedded, light grayish-yellow, slightly recrystallized micrite, very fine-grain biomicrite and medium-gray dolomitized micrite; other features:
--at 127: hard streaks--crusts(?)
--at 128, 135: light- to medium-gray chert nodules
--at 133-135, 137-138: distinct channeling and lensing with lithoclasts in channels.. 12.5'

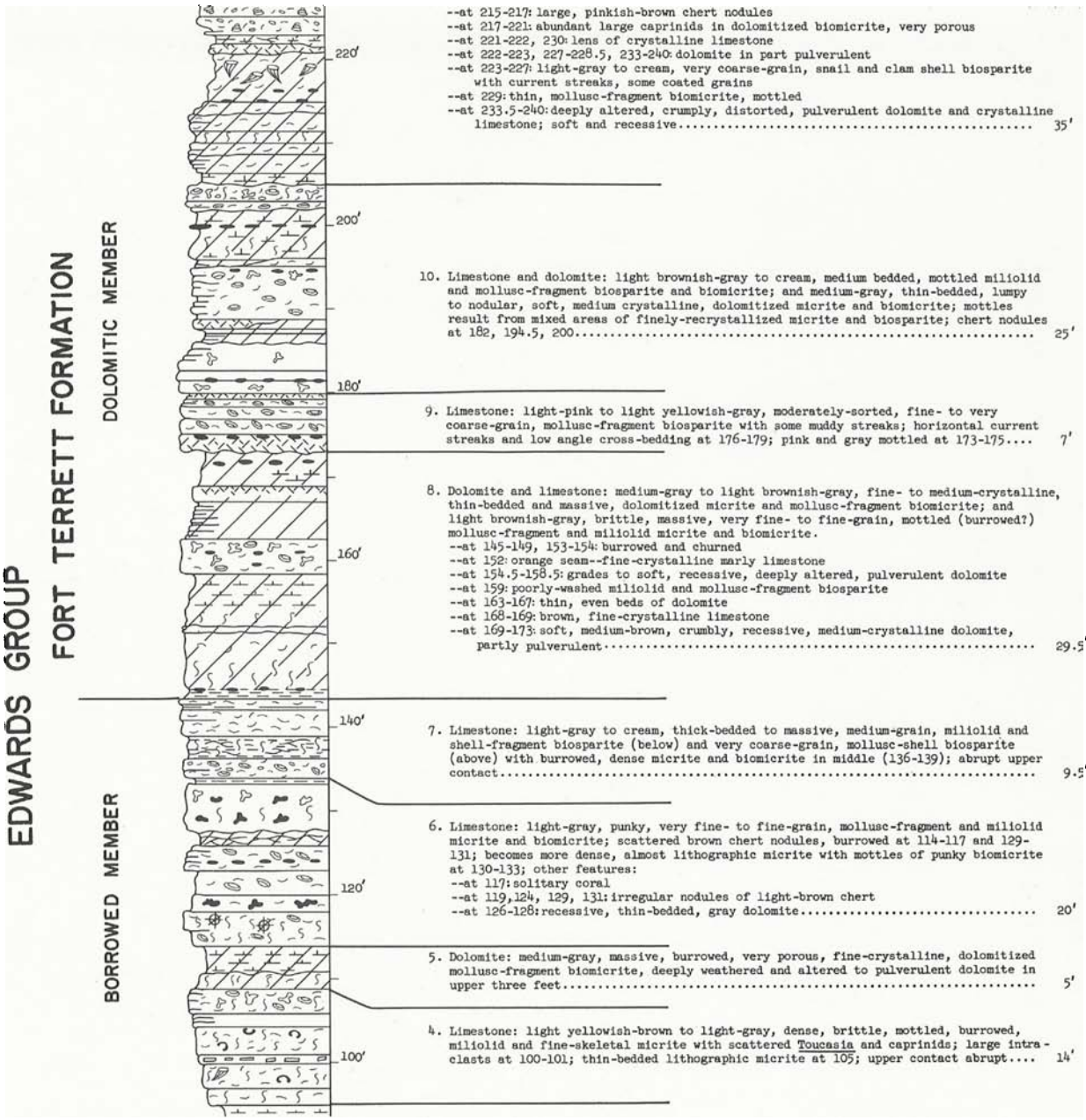
4. Limestone: light yellowish-gray to cream, massive, poorly-sorted, whole-rudist biomicrite; matrix is fine-grain, miliolid and mollusc-fragment biomicrite; Toucasia predominates, but caprinids are numerous at 108.5-111; other features:
--at 111: reddish-gray chert nodules
--at 112.5-113, 125-126: micrite streaks
--at 119-120: marly streak
--at 124: becomes muddier..... 17.5'

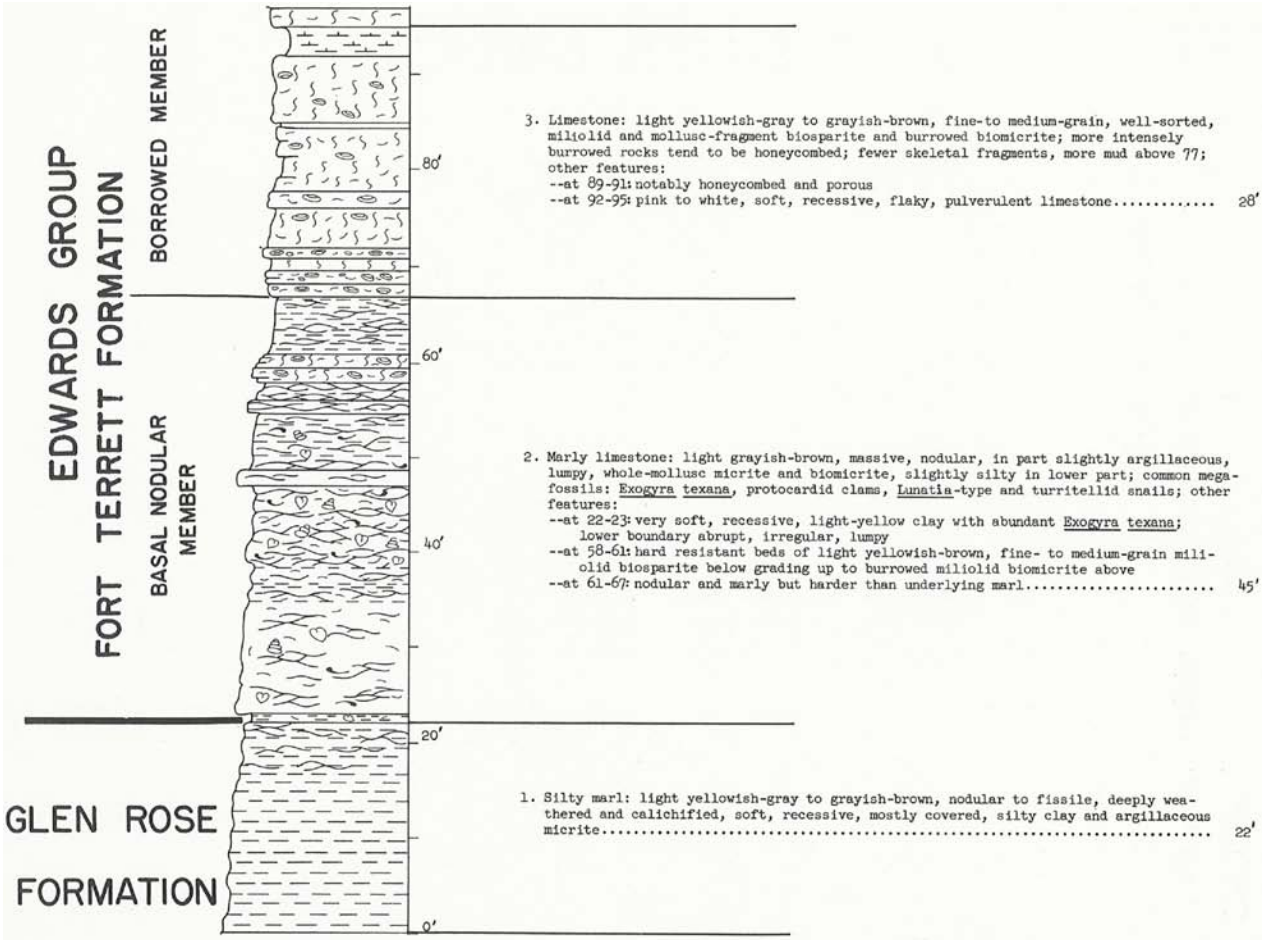


LOCATION MAP

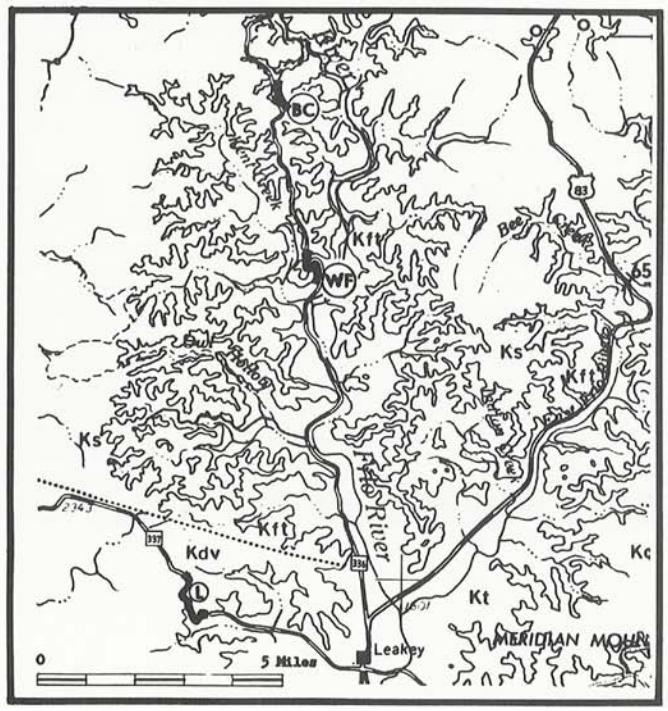
WEST FRIO


EDWARDS GROUP
FORT TERRETT FORMATION
KIRSCHBERG EVAPORITE
SEGOVIA FORMATION
BURT RANCH MEMBER
360'
340'
320'
300'
280'
260'
240'
220'
22. Limestone: light grayish-brown, medium-bedded to massive-bedded, mollusc-fragment and miliolid biomicrite; mottled beds at 368, 370 371-374; burrowed at 372-374; other features:
--at 374.5-377: dense, light grayish-brown micrite--slightly marly; dark-brown chert at base of interval..... 14'
21. Limestone: light-brown to tan, medium- to coarse-grain, porous, mollusc-fragment biosparite; poor to moderate sorting; beds weather as thick to massive rounded ledges; other features:
--at 362-363: fine-grain, with some dark-gray micrite streaks
--at 363-365: silicified Gryphaea fragments..... 11'
20. Covered..... 7'
19. Limestone: light brownish-gray, medium- to thin-bedded, mollusc-fragment and miliolid biomicrite with scattered, thin, marly to flaggy streaks..... 9'
18. Crystalline limestone and dolomite: medium-brown to yellow-orange, fine-crystalline, dense, cherty crystalline limestone with thin-beds of gray, medium- to fine-crystalline dolomite at 328, 337..... 12'
17. Marl and limestone: yellowish-gray to cream, soft, crumbly, massive, nodular to fissile, recessive, argillaceous whole-mollusc micrite; scattered medium-bedded limestone intervals:
--at 299-303, 309-310: marly biomicrite
--at 310-312: miliolid and mollusc-fragment biosparite
other features:
--at 297 and 304: yellow-orange, massive dolomitic marl
--at 312-320: very soft cream marl with abundant oyster and other pelecypod fragments
--at 314-317: common very large Exogyra texana
--at 306-308: common slender burrow fills, straight, about a quarter inch in diameter few echinoids in this interval..... 31'
16. Limestone: light grayish-brown to cream, thin-bedded, very fine-grain grading up to medium-grain, very well-sorted, miliolid and mollusc-fragment biosparite; very slightly recrystallized in basal two feet; other features:
--at 286: coalescing yellow marl seams
--at 291-292: becomes muddy
--at 292: brownish-gray nodular marly streak
--at 293-295: miliolid biosparite grading up to biomicrite; clear truncation of two beds beneath upper contact..... 19'
15. Limestone: light grayish-brown, thin-bedded, dense, lithographic micrite and fine- to medium-grain, mollusc-fragment and miliolid biomicrite; darker-gray at 269-271; sharp contact at 274 with overlying beds of recrystallized micrite like below; upper boundary is undulatory orange marly streak that truncates beds below..... 7'
14. Dolomite and crystalline limestone: light-gray, soft, punky, porous, medium- to fine-crystalline, thin-bedded and massive dolomitized micrite; chert nodules at 260, 268; light-brown chert bed at 264.5; patches of medium crystalline recrystallized limestone grading laterally to dolomite in top few feet..... 13'
13. Limestone: light grayish-brown, brittle and fractured, thin- to medium-bedded, lithographic micrite and fine-grain, mollusc-fragment and miliolid biomicrite; top bed medium-crystalline recrystallized limestone..... 8'
12. Limestone and collapse breccia: very dark-gray dolomite, slightly recrystallized micrite beneath very coarse collapse breccia composed of very dark-gray, fine-crystalline micrite, and light-brown, dense lithographic micrite; breccia grades laterally to thin-bedded limestone..... 8'
11. Dolomite: light to medium brownish-gray, soft to hard, medium- to thick-bedded, medium- to fine-crystalline, porous, dolomitized, mollusc-fragment biomicrite; other features:
--at 210-211, 233.5-237: burrowed
--at 215-217: large, pinkish-brown chert nodules
--at 217-221: abundant large caprinids in dolomitized biomicrite, very porous
--at 221-222, 230: lens of crystalline limestone
--at 222-223, 227-228.5, 233-240: dolomite in part pulverulent
--at 223-227: light-gray to cream, very coarse-grain, snail and clam shell biosparite with current streaks, some coated grains
--at 229: thin, mollusc-fragment biomicrite, mottled
--at 233.5-240: deeply altered, crumply, distorted, pulverulent dolomite and crystalline limestone; soft and recessive..... 35'

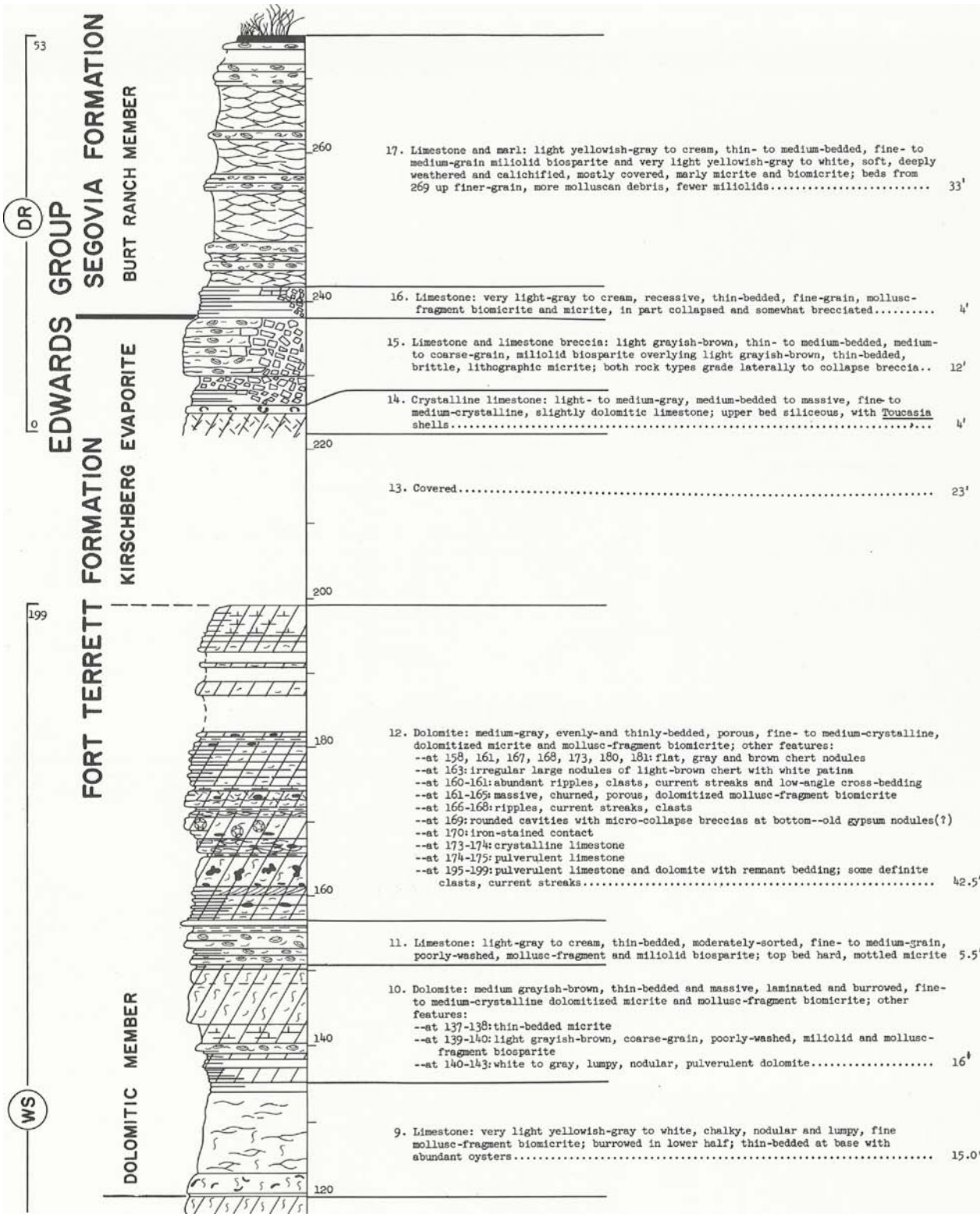

EDWARDS GROUP
FORT TERRETT FORMATION
DOLOMITIC MEMBER
BORROWED MEMBER
220'
200'
180'
160'
140'
120'
100'
--at 215-217: large, pinkish-brown chert nodules
--at 217-221: abundant large caprinids in dolomitized biomicrite, very porous
--at 221-222, 230: lens of crystalline limestone
--at 222-223, 227-228.5, 233-240: dolomite in part pulverulent
--at 223-227: light-gray to cream, very coarse-grain, snail and clam shell biosparite with current streaks, some coated grains
--at 229: thin, mollusc-fragment biomicrite, mottled
--at 233.5-240: deeply altered, crumply, distorted, pulverulent dolomite and crystalline limestone; soft and recessive..... 35'
10. Limestone and dolomite: light brownish-gray to cream, medium bedded, mottled miliolid and mollusc-fragment biosparite and biomicrite; and medium-gray, thin-bedded, lumpy to nodular, soft, medium crystalline, dolomitized micrite and biomicrite; mottles result from mixed areas of finely-recrystallized micrite and biosparite; chert nodules at 182, 194.5, 200..... 25'
9. Limestone: light-pink to light yellowish-gray, moderately-sorted, fine- to very coarse-grain, mollusc-fragment biosparite with some muddy streaks; horizontal current streaks and low angle cross-bedding at 176-179; pink and gray mottled at 173-175.... 7'
8. Dolomite and limestone: medium-gray to light brownish-gray, fine- to medium-crystalline, thin-bedded and massive, dolomitized micrite and mollusc-fragment biomicrite; and light brownish-gray, brittle, massive, very fine- to fine-grain, mottled (burrowed?) mollusc-fragment and miliolid micrite and biomicrite.
--at 145-149, 153-154: burrowed and churned
--at 152: orange seam--fine-crystalline marly limestone
--at 154.5-158.5: grades to soft, recessive, deeply altered, pulverulent dolomite
--at 159: poorly-washed miliolid and mollusc-fragment biosparite
--at 163-167: thin, even beds of dolomite
--at 168-169: brown, fine-crystalline limestone
--at 169-173: soft, medium-brown, crumbly, recessive, medium-crystalline dolomite, partly pulverulent..... 29.5'
7. Limestone: light-gray to cream, thick-bedded to massive, medium-grain, miliolid and shell-fragment biosparite (below) and very coarse-grain, mollusc-shell biosparite (above) with burrowed, dense micrite and biomicrite in middle (136-139); abrupt upper contact..... 9.5'
6. Limestone: light-gray, punky, very fine- to fine-grain, mollusc-fragment and miliolid micrite and biomicrite; scattered brown chert nodules, burrowed at 114-117 and 129-131; becomes more dense, almost lithographic micrite with mottles of punky biomicrite at 130-133; other features:
--at 117: solitary coral
--at 119,124, 129, 131: irregular nodules of light-brown chert
--at 126-128: recessive, thin-bedded, gray dolomite..... 20'
5. Dolomite: medium-gray, massive, burrowed, very porous, fine-crystalline, dolomitized mollusc-fragment biomicrite, deeply weathered and altered to pulverulent dolomite in upper three feet..... 5'
4. Limestone: light yellowish-brown to light-gray, dense, brittle, mottled, burrowed, miliolid and fine-skeletal micrite with scattered Toucasia and caprinids; large intra-clasts at 100-101; thin-bedded lithographic micrite at 105; upper contact abrupt.... 14'

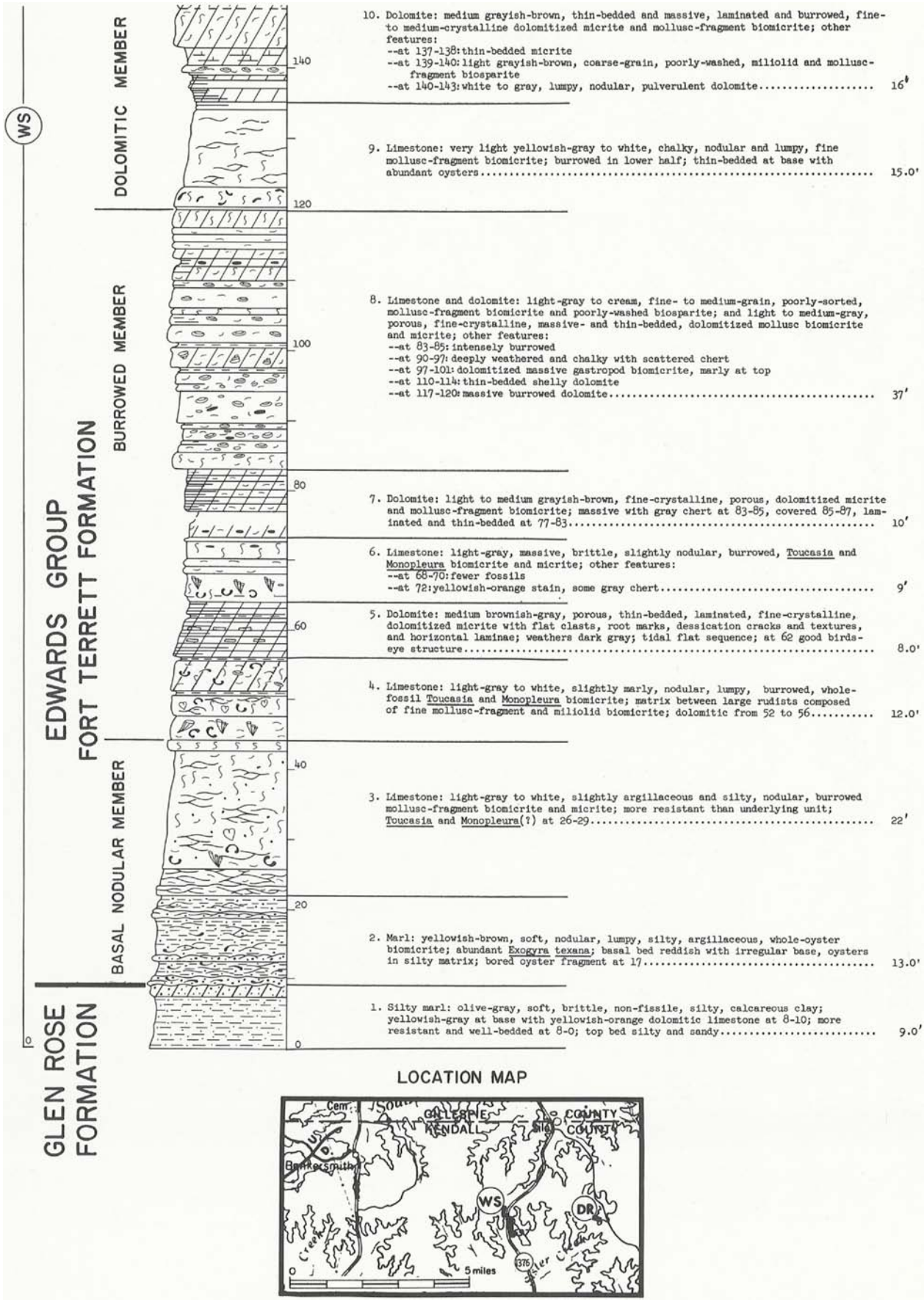


LOCATION MAP

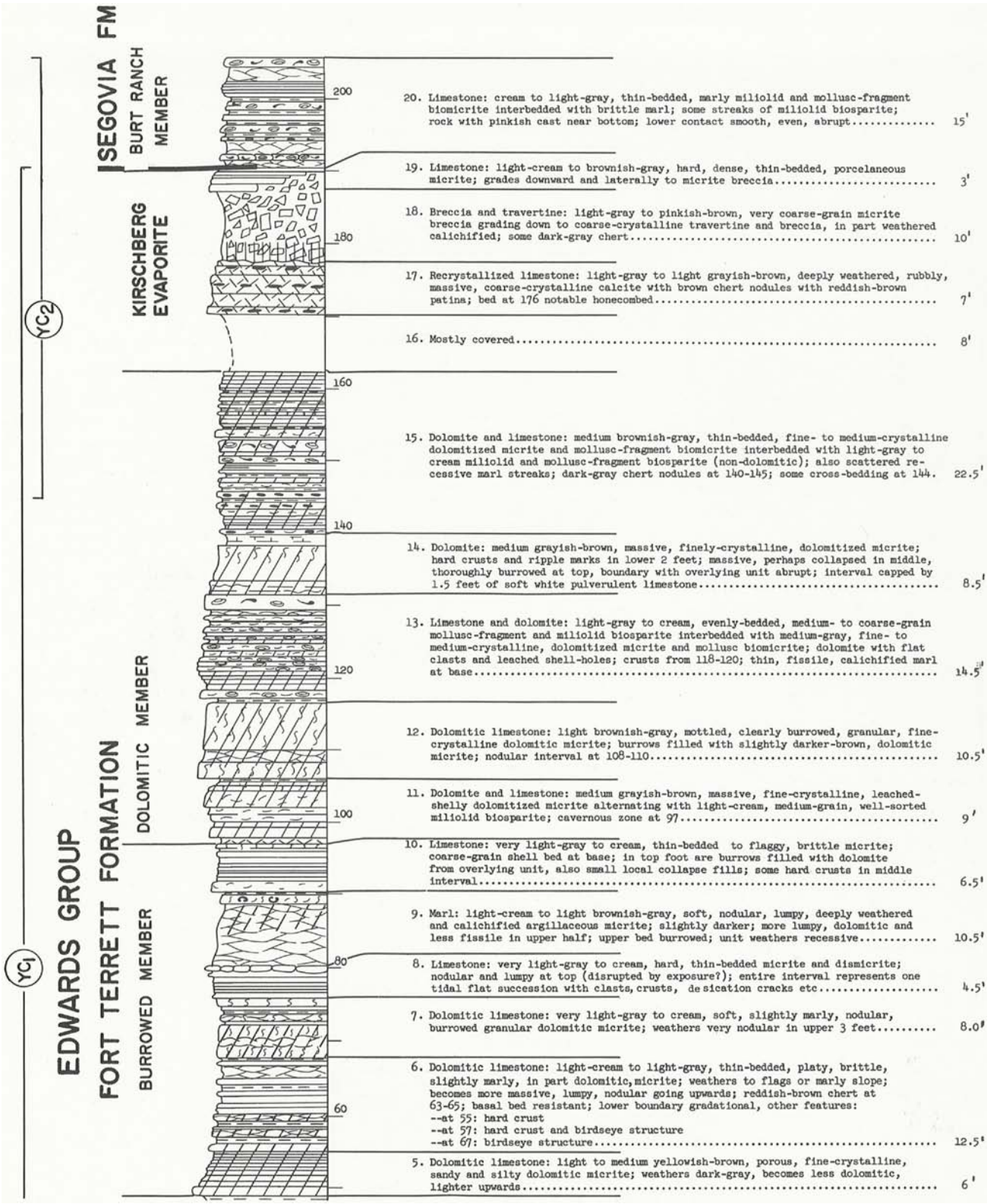


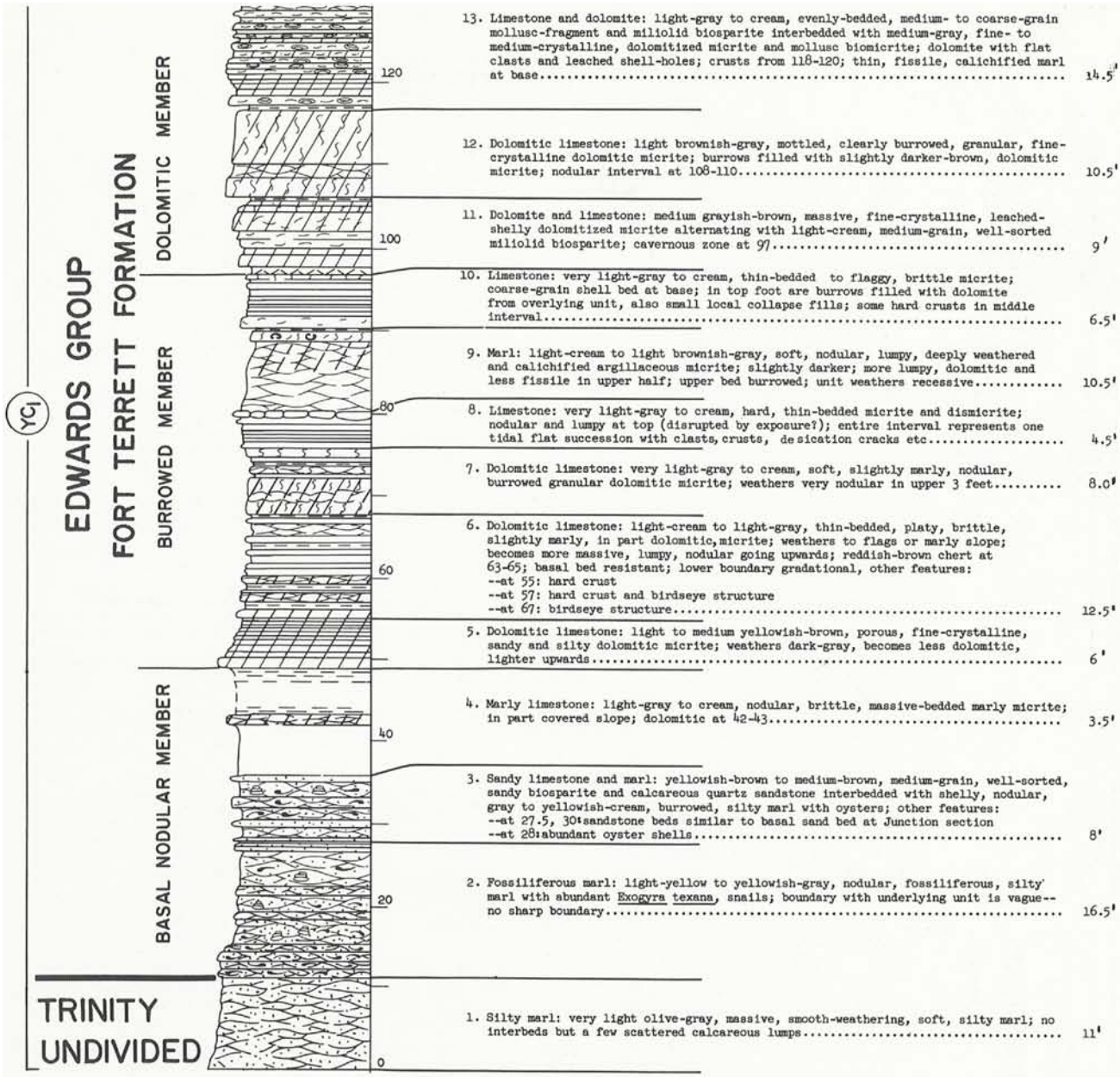
WEST SISTER CREEK




WS
EDWARDS GROUP
FORT TERRETT FORMATION
DOLOMITIC MEMBER
BURROWED MEMBER
BASAL NODULAR MEMBER
GLEN ROSE FORMATION
140
120
100
80
60
40
20
0
10. Dolomite: medium grayish-brown, thin-bedded and massive, laminated and burrowed, fine- to medium-crystalline dolomitized micrite and mollusc-fragment biomicrite; other features:
--at 137-138: thin-bedded micrite
--at 139-140: light grayish-brown, coarse-grain, poorly-washed, miliolid and mollusc-fragment biosparite
--at 140-143: white to gray, lumpy, nodular, pulverulent dolomite..... 16'
9. Limestone: very light yellowish-gray to white, chalky, nodular and lumpy, fine mollusc-fragment biomicrite; burrowed in lower half; thin-bedded at base with abundant oysters..... 15.0'
8. Limestone and dolomite: light-gray to cream, fine- to medium-grain, poorly-sorted, mollusc-fragment biomicrite and poorly-washed biosparite; and light to medium-gray, porous, fine-crystalline, massive- and thin-bedded, dolomitized mollusc biomicrite and micrite; other features:
--at 83-85: intensely burrowed
--at 90-97: deeply weathered and chalky with scattered chert
--at 97-101: dolomitized massive gastropod biomicrite, marly at top
--at 110-114: thin-bedded shelly dolomite
--at 117-120: massive burrowed dolomite..... 37'
7. Dolomite: light to medium grayish-brown, fine-crystalline, porous, dolomitized micrite and mollusc-fragment biomicrite; massive with gray chert at 83-85, covered 85-87, laminated and thin-bedded at 77-83..... 10'
6. Limestone: light-gray, massive, brittle, slightly nodular, burrowed, Toucasia and Monopleura biomicrite and micrite; other features:
--at 68-70: fewer fossils
--at 72: yellowish-orange stain, some gray chert..... 9'
5. Dolomite: medium brownish-gray, porous, thin-bedded, laminated, fine-crystalline, dolomitized micrite with flat clasts, root marks, dessication cracks and textures, and horizontal laminae; weathers dark gray; tidal flat sequence; at 62 good birds-eye structure..... 8.0'
4. Limestone: light-gray to white, slightly marly, nodular, lumpy, burrowed, whole-fossil Toucasia and Monopleura biomicrite; matrix between large rudists composed of fine mollusc-fragment and miliolid biomicrite; dolomitic from 52 to 56..... 12.0'
3. Limestone: light-gray to white, slightly argillaceous and silty, nodular, burrowed mollusc-fragment biomicrite and micrite; more resistant than underlying unit; Toucasia and Monopleura(?) at 26-29..... 22'
2. Marl: yellowish-brown, soft, nodular, lumpy, silty, argillaceous, whole-oyster biomicrite; abundant Exogyra texana; basal bed reddish with irregular base, oysters in silty matrix; bored oyster fragment at 17..... 13.0'
1. Silty marl: olive-gray, soft, brittle, non-fissile, silty, calcareous clay; yellowish-gray at base with yellowish-orange dolomitic limestone at 8-10; more resistant and well-bedded at 8-0; top bed silty and sandy..... 9.0'
LOCATION MAP
Cem
GILLESPIE
KENDALL
COUNTY
WS
DR
5 miles
376

YATES CROSSING





13. Limestone and dolomite: light-gray to cream, evenly-bedded, medium- to coarse-grain mollusc-fragment and miliolid biosparite interbedded with medium-gray, fine- to medium-crystalline, dolomitized micrite and mollusc biomicrite; dolomite with flat clasts and leached shell-holes; crusts from 118-120; thin, fissile, calichified marl at base..... 14.5'

12. Dolomitic limestone: light brownish-gray, mottled, clearly burrowed, granular, fine-crystalline dolomitic micrite; burrows filled with slightly darker-brown, dolomitic micrite; nodular interval at 108-110..... 10.5'

11. Dolomite and limestone: medium grayish-brown, massive, fine-crystalline, leached-shelly dolomitized micrite alternating with light-cream, medium-grain, well-sorted miliolid biosparite; cavernous zone at 97..... 9'

10. Limestone: very light-gray to cream, thin-bedded to flaggy, brittle micrite; coarse-grain shell bed at base; in top foot are burrows filled with dolomite from overlying unit, also small local collapse fills; some hard crusts in middle interval..... 6.5'

9. Marl: light-cream to light brownish-gray, soft, nodular, lumpy, deeply weathered and calichified argillaceous micrite; slightly darker; more lumpy, dolomitic and less fissile in upper half; upper bed burrowed; unit weathers recessive..... 10.5'

8. Limestone: very light-gray to cream, hard, thin-bedded micrite and dismicrite; nodular and lumpy at top (disrupted by exposure?); entire interval represents one tidal flat succession with clasts, crusts, desication cracks etc..... 4.5'

7. Dolomitic limestone: very light-gray to cream, soft, slightly marly, nodular, burrowed granular dolomitic micrite; weathers very nodular in upper 3 feet..... 8.0'

6. Dolomitic limestone: light-cream to light-gray, thin-bedded, platy, brittle, slightly marly, in part dolomitic micrite; weathers to flags or marly slope; becomes more massive, lumpy, nodular going upwards; reddish-brown chert at 63-65; basal bed resistant; lower boundary gradational, other features:
--at 55: hard crust
--at 57: hard crust and birdseye structure
--at 67: birdseye structure..... 12.5'

5. Dolomitic limestone: light to medium yellowish-brown, porous, fine-crystalline, sandy and silty dolomitic micrite; weathers dark-gray, becomes less dolomitic, lighter upwards..... 6'

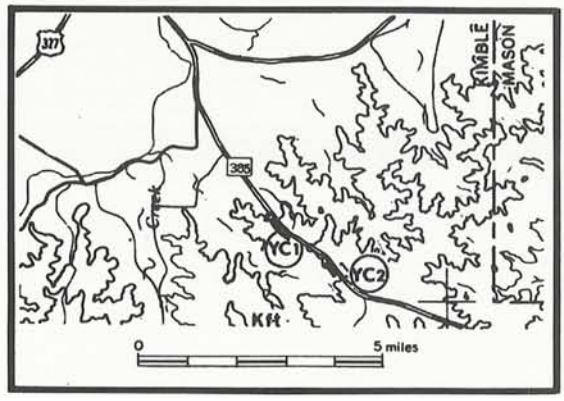
4. Marly limestone: light-gray to cream, nodular, brittle, massive-bedded marly micrite; in part covered slope; dolomitic at 42-43..... 3.5'

3. Sandy limestone and marl: yellowish-brown to medium-brown, medium-grain, well-sorted, sandy biosparite and calcareous quartz sandstone interbedded with shelly, nodular, gray to yellowish-cream, burrowed, silty marl with oysters; other features:
--at 27.5, 30' sandstone beds similar to basal sand bed at Junction section
--at 28' abundant oyster shells..... 8'

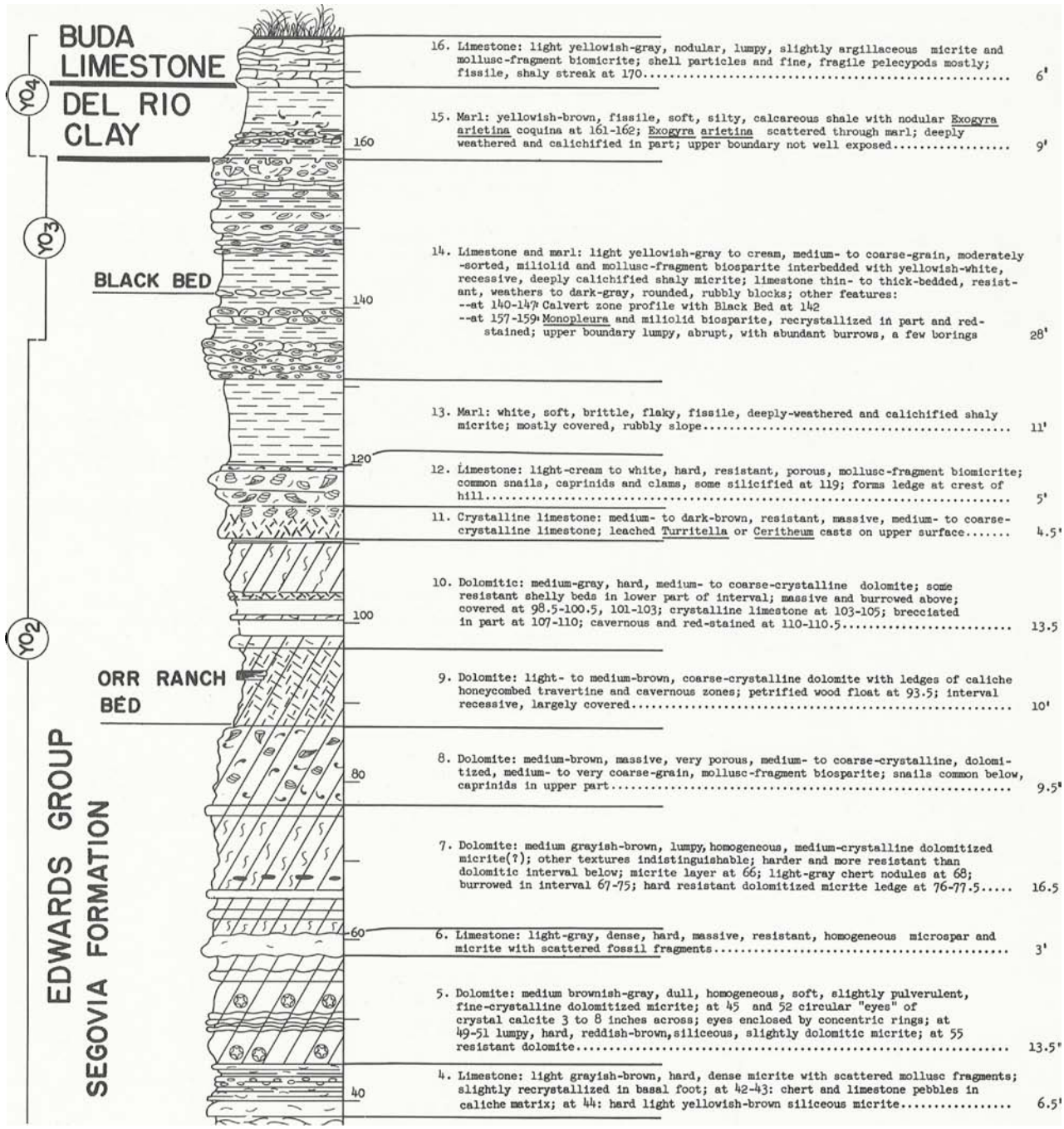
2. Fossiliferous marl: light-yellow to yellowish-gray, nodular, fossiliferous, silty marl with abundant Exogyra texana, snails; boundary with underlying unit is vague--no sharp boundary..... 16.5'

1. Silty marl: very light olive-gray, massive, smooth-weathering, soft, silty marl; no interbeds but a few scattered calcareous lumps..... 11'

LOCATION MAP



Y O RANCH



16. Limestone: light yellowish-gray, nodular, lumpy, slightly argillaceous micrite and mollusc-fragment biomicrite; shell particles and fine, fragile pelecypods mostly; fissile, shaly streak at 170..... 6'

15. Marl: yellowish-brown, fissile, soft, silty, calcareous shale with nodular Exogyra arietina coquina at 161-162; Exogyra arietina scattered through marl; deeply weathered and calichified in part; upper boundary not well exposed..... 9'

14. Limestone and marl: light yellowish-gray to cream, medium- to coarse-grain, moderately -sorted, miliolid and mollusc-fragment biosparite interbedded with yellowish-white, recessive, deeply calichified shaly micrite; limestone thin- to thick-bedded, resistant, weathers to dark-gray, rounded, rubbly blocks; other features:
--at 140-147: Calvert zone profile with Black Bed at 142
--at 157-159: Monopleura and miliolid biosparite, recrystallized in part and red-stained; upper boundary lumpy, abrupt, with abundant burrows, a few borings 28'

13. Marl: white, soft, brittle, flaky, fissile, deeply-weathered and calichified shaly micrite; mostly covered, rubbly slope..... 11'

12. Limestone: light-cream to white, hard, resistant, porous, mollusc-fragment biomicrite; common snails, caprinids and clams, some silicified at 119; forms ledge at crest of hill..... 5'

11. Crystalline limestone: medium- to dark-brown, resistant, massive, medium- to coarse-crystalline limestone; leached Turritella or Cerithеum casts on upper surface..... 4.5'

10. Dolomitic: medium-gray, hard, medium- to coarse-crystalline dolomite; some resistant shelly beds in lower part of interval; massive and burrowed above; covered at 98.5-100.5, 101-103; crystalline limestone at 103-105; brecciated in part at 107-110; cavernous and red-stained at 110-110.5..... 13.5

9. Dolomite: light- to medium-brown, coarse-crystalline dolomite with ledges of caliche honeycombed travertine and cavernous zones; petrified wood float at 93.5; interval recessive, largely covered..... 10'

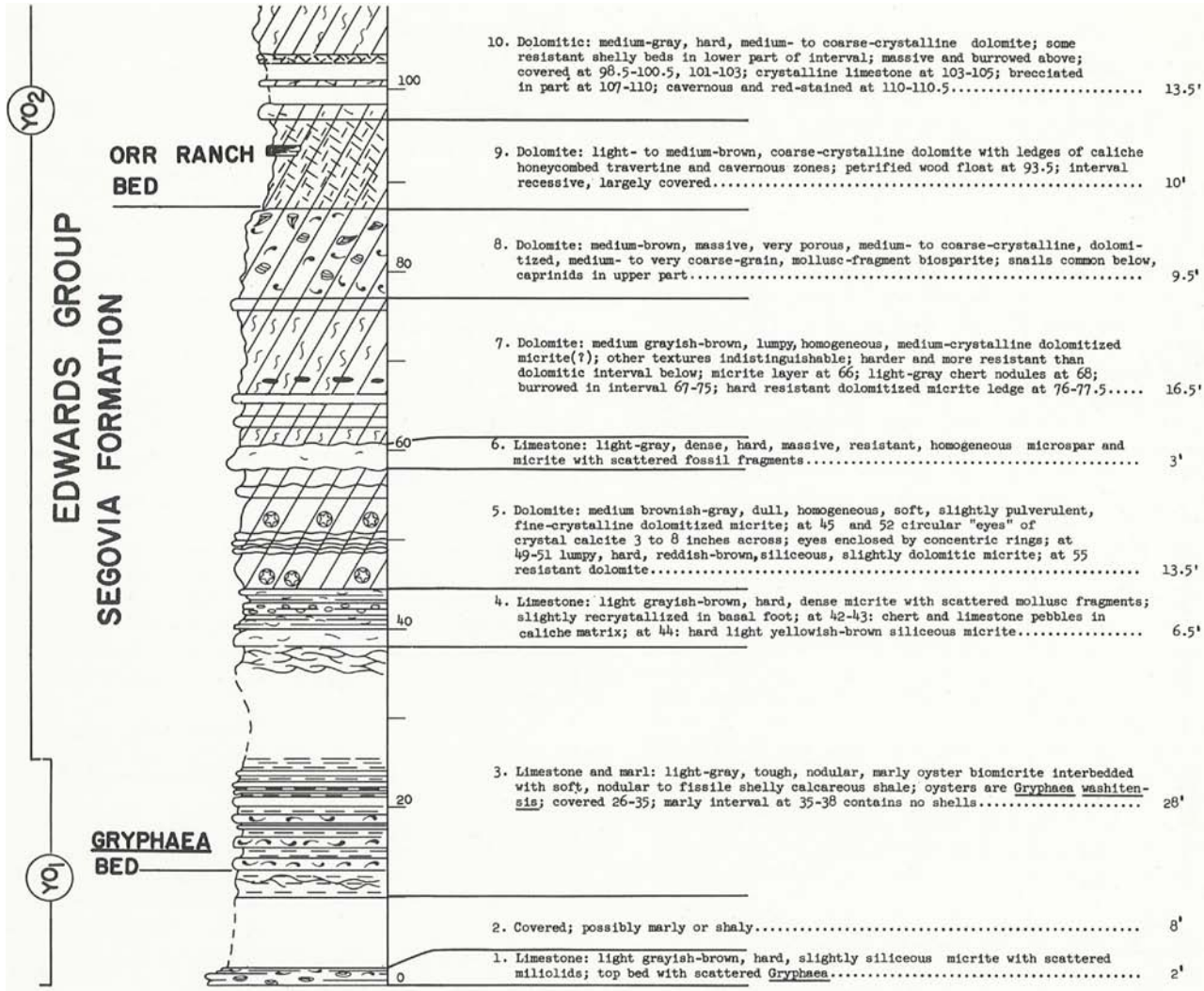
8. Dolomite: medium-brown, massive, very porous, medium- to coarse-crystalline, dolomitized, medium- to very coarse-grain, mollusc-fragment biosparite; snails common below, caprinids in upper part..... 9.5'

7. Dolomite: medium grayish-brown, lumpy, homogeneous, medium-crystalline dolomitized micrite(?); other textures indistinguishable; harder and more resistant than dolomitic interval below; micrite layer at 66; light-gray chert nodules at 68; burrowed in interval 67-75; hard resistant dolomitized micrite ledge at 76-77.5..... 16.5

6. Limestone: light-gray, dense, hard, massive, resistant, homogeneous microspar and micrite with scattered fossil fragments..... 3'

5. Dolomite: medium brownish-gray, dull, homogeneous, soft, slightly pulverulent, fine-crystalline dolomitized micrite; at 45 and 52 circular "eyes" of crystal calcite 3 to 8 inches across; eyes enclosed by concentric rings; at 49-51 lumpy, hard, reddish-brown, siliceous, slightly dolomitic micrite; at 55 resistant dolomite..... 13.5'

4. Limestone: light grayish-brown, hard, dense micrite with scattered mollusc fragments; slightly recrystallized in basal foot; at 42-43: chert and limestone pebbles in caliche matrix; at 44: hard light yellowish-brown siliceous micrite..... 6.5'



10. Dolomitic: medium-gray, hard, medium- to coarse-crystalline dolomite; some resistant shelly beds in lower part of interval; massive and burrowed above; covered at 98.5-100.5, 101-103; crystalline limestone at 103-105; brecciated in part at 107-110; cavernous and red-stained at 110-110.5..... 13.5'

9. Dolomite: light- to medium-brown, coarse-crystalline dolomite with ledges of caliche honeycombed travertine and cavernous zones; petrified wood float at 93.5; interval recessive, largely covered..... 10'

8. Dolomite: medium-brown, massive, very porous, medium- to coarse-crystalline, dolomitized, medium- to very coarse-grain, mollusc-fragment biosparite; snails common below, caprinids in upper part..... 9.5'

7. Dolomite: medium grayish-brown, lumpy, homogeneous, medium-crystalline dolomitized micrite(?); other textures indistinguishable; harder and more resistant than dolomitic interval below; micrite layer at 66; light-gray chert nodules at 68; burrowed in interval 67-75; hard resistant dolomitized micrite ledge at 76-77.5..... 16.5'

6. Limestone: light-gray, dense, hard, massive, resistant, homogeneous microspar and micrite with scattered fossil fragments..... 3'

5. Dolomite: medium brownish-gray, dull, homogeneous, soft, slightly pulverulent, fine-crystalline dolomitized micrite; at 45 and 52 circular "eyes" of crystal calcite 3 to 8 inches across; eyes enclosed by concentric rings; at 49-51 lumpy, hard, reddish-brown, siliceous, slightly dolomitic micrite; at 55 resistant dolomite..... 13.5'

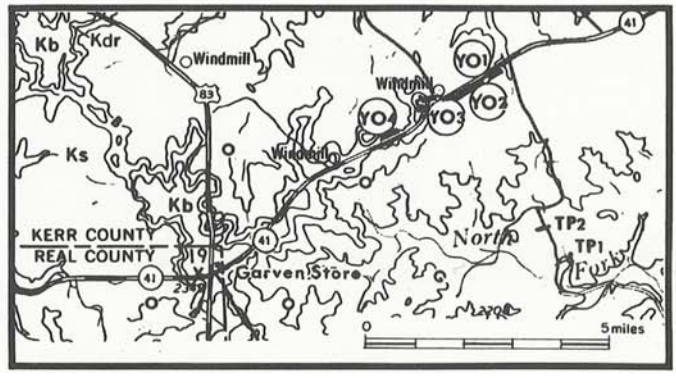
4. Limestone: light grayish-brown, hard, dense micrite with scattered mollusc fragments; slightly recrystallized in basal foot; at 42-43: chert and limestone pebbles in caliche matrix; at 44: hard light yellowish-brown siliceous micrite..... 6.5'

3. Limestone and marl: light-gray, tough, nodular, marly oyster biomicrite interbedded with soft, nodular to fissile shelly calcareous shale; oysters are Gryphaea washitensis; covered 26-35; marly interval at 35-38 contains no shells..... 28'

2. Covered; possibly marly or shaly..... 8'

1. Limestone: light grayish-brown, hard, slightly siliceous micrite with scattered miliolids; top bed with scattered Gryphaea..... 2'

LOCATION MAP



APPENDIX D

LOCALITIES

Field localities encountered during the surface mapping and judged sufficiently significant to warrant description are listed by number and approximate location; precise location is shown on the geologic map (Pl. 1). Localities 11, 26, 28, 36, and 52 are omitted purposely.

1. On Pecan Creek road at intersection with west-leading county road about 6 miles northwest of Fredericksburg, Gillespie County: uppermost Fort Terrett overlain by Dr. Burt zone, showing definite interbedded marl and miliolid biosparite in basal Burt Ranch Member, plus a thin porcellaneous micrite and collapse breccia at the top of the Fort Terrett.

2. On county road leading south from Harper cemetery about 0.5 mile south of U. S. Highway 290 on south bank of creek, Gillespie County: uppermost Fort Terrett and lower Burt Ranch Member, with brecciated porcellaneous micrite (Fort Terrett) overlain by fossiliferous Dr. Burt marl with *Exogyra texana, Tylostoma* sp., protocardid clams.

3. On Belton Tatsch ranch, Kimble County, about 8 miles west-northwest of Harper: fossiliferous basal Dr. Burt zone exposed roughly 0.5 mile south of ranch headquarters on east bank of dry creek bed, in contact with Fort Terrett; boundary abrupt, irregular, red stained; fossils: *Exogyra texana, Tylostoma* sp., *Enallaster,* protocardid clams, elongate "razor clam"-like pelecypod.

4. Silicified caprinids and gastropods on J. H. Parker ranch, Kimble County, 13 miles west-northwest of Harper; locality is about 1 mile southeast of the ranchhouse on top of a hill about 0.25 mile west of well-traveled ranch road; appears to be a mound-form about 100 yards in diameter and lies perhaps 60 feet stratigraphically above the *Gryphaea* Bed.

5. Beside Ranch Road 385 on crest of divide in Kimble County about 4 miles northwest of Harper: abundant fragments, some large, of petrified wood.

6. Abandoned prospect pit on Kirschberg farm about 7 miles north of Fredericksburg, Gillespie County: prominent collapse structure in uppermost Fort Terrett and solution-channeled massive gypsum; loose *Toucasia* specimens, and colonies of *Cladophyllia,* totally dolomitized and weathering out of pulverulent dolomite above gypsum; Barnes's (1944) type Kirschberg.

7. Beside county road about 1 mile southwest of Cherry Spring, Gillespie County: Fort Terrett—Hensel contact.

8. About 2 miles northwest of Crabapple School, Gillespie County, along paved county road: superb exposure of Hensel—Fort Terrett boundary, sequence as follows:

	Thickness (feet)
Fort Terrett Formation—	
4. Thin-bedded to massive, nodular brown dolomite	~40.0
3. Light-gray, sandy marl with large fossiliferous sandstone boulders containing high-spired snails	1.0
2. Light grayish-brown, sandy rotten marl	1.5
Hensel Formation—	
1. Medium-brown, fine- to medium-grained, massive, burrowed sandstone	10.0

9. On old Fred Burt ranch about 11 miles south of Junction and roughly 7 miles southeast of South Llano River, Kimble County; in 1967 leased by a Mr. Tomlinson; base of Burt Ranch Member is about 0.25 mile west of county road at dry creek crossing; upper part of marly zone is well exposed about 0.25 mile farther south in bluffs east of road; poorly preserved oxytropidoceroid ammonites noted in creek bed outcrops; Pavlovic's locality of the Dr. Burt zone (personal communication, Robert Pavlovic, June 1967).

10. Immediately west of farm road 4 miles northeast of Harper, Gillespie County: excellent exposures of collapse structures related to Allen Ranch Breccia; *Gryphaea* Bed crops out near higher (north) edge of field about 200 yards northeast of collapse and about 30 feet higher stratigraphically.

12. Six miles south of Telegraph and 1 mile northeast of foreman's house (Mr. Rathke in 1967) on 700 Springs ranch, Edwards County: on east bank of draw about 300 yards north of field is exposure of Kirschberg breccia overlain by essentially undisturbed marl, micrite, and miliolid biosparite beds of Burt Ranch Member; shows that brecciation was pre-Burt Ranch.

13. Six miles southwest of Telegraph, along west side of U. S. Highway 377, Edwards County: good exposure of upper Fort Terrett and Burt Ranch; Kirschberg breccia well developed.

14. About 7 miles south of Telegraph in bottom of draw about 0.25 mile east of windmill near shearing barns on 700 Springs ranch, Edwards County: excellent exposure of Burt Ranch—Fort Terrett boundary. Upper Fort Terrett consists of brecciated, fractured, and collapse-folded porcellaneous micrite and about 1 or 2 inches of brown, well-sorted, fine-grained miliolid biosparite. Boundary is red-stained, lumpy and bumpy with distinct borings and *Exogyra texana* cemented onto the contact. Dr. Burt zone consists of 1 foot of soft yellowish-brown marl with *Exogyra texana* overlain by about 12 feet of nodular yellowish-brown marly micrite and biomicrite. The lower 4 feet of the Dr. Burt zone duplicates the folding of the Fort Terrett and fills a few "pipes" down into the Fort Terrett; beds more than 4 feet above the boundary are essentially flat-lying and unfolded.

15. Quarry about 3 miles north of intersection of U. S. Highway 377 and State Highway 41 east of Rocksprings, Edwards County: Black Bed exposed in base of quarry, with about 10 feet of massive limestone above. Black Bed occurs both as lumps and as black burrow-fills in underlying biomicrite.

16. About 2 miles east of intersection of U. S. Highway 377 and State Highway 41, Edwards County: short section measured beside ranch road just south of State Highway 41 on Morris ranch about 3,000 feet east of ranch headquarters, from Black Bed to Buda (interval 45 feet). About 1 foot above Black Bed is limestone conglomerate with distinct erosional surface.

17. Quarry on Lee Hyde ranch 400 yards east of red gate by State Highway 335, 0.5 mile south of intersection of State Highways 335 and 41, Edwards County: excellent exposure on northeast wall shows Buda resting unconformably on Segovia with 3 to 4 feet of erosional relief; bored Del Rio pebbles and weathered *Exogyra arietina* in base of Buda, but no Del Rio beds.

18. Caliche pit on north side of State Highway 41, 1 mile west of intersection of State Highways 41 and 336 (Prade ranch road) on Dietert ranch, Real County: Black Bed about 15 feet below top of Segovia west of caliche pit; 1 to 2 feet of Del Rio (reddish-brown, calcareous silty clay with *Exogyra arietina* coquina at base, grading up to probable regolith) overlain by Buda (1 foot of bouldery marl overlain by 2 feet of typical Buda nodular micrite).

19. Quarries on north side of State Highway 41, 0.25 mile west of Garven Store, Real County: excellent outcrop of Black Bed 3 feet below top of Segovia; top of Segovia is a red-stained bored surface overlain by 1 foot of *Exogyra arietina* coquina, in turn succeeded by about 5 feet of weathered nodular lumpy yellowish-brown marl containing scattered *Exogyra arietina* (all Del Rio), overlain by about 1 foot of light yellowish-gray, nodular micrite (Buda).

20. Bluff on east side of south-flowing tributary of South Llano River on Guthrie lease, Edwards County, about 1 mile southwest of Telegraph: 25 feet of nodular Burt Ranch rests directly on uppermost Fort Terrett that consists of about 15 feet of medium-bedded micrite grading laterally to collapse breccia.

21. About 50 yards south of Barnhardt house beside county road, about 0.5 mile south of U. S. Highway 290, Kimble County, roughly 7 miles east of intersection of U. S. Highway 290 and State Highway 27: good fossiliferous outcrop of Dr. Burt marl; poor thin-ribbed ammonite found about 7 feet above base of marl identified by K. P. Young as either *Oxytropidoceras stenzeli* or *Adkinsites bravoensis*; other fossils: *Exogyra texana*, "razor clams," *Tylostoma* sp., *Trigonia* sp., *Lituola* sp.

22. On Bill Orr ranch, about 1 mile east of intersection of State Highways 41 and 336 (Prade ranch road), Real County: two mounds of reddish-brown silicified caprinid reef; one mound due west of barn about 0.5 mile northwest of ranch headquarters; the other mound is about 0.25 mile south of the first mound.

23. Creek bed just east of graded county road that turns west from U. S. Highway 83 about 3 miles south of intersection of U. S. Highways 290 and 83 in Kimble County southeast of Junction: Allen Ranch collapse breccia as large float blocks and *in situ* in creek bed; *Gryphaea* Bed lies 30 to 35 feet vertically above on hillside to west.

24. In creek bed immediately south of ranch headquarters and out-buildings on Epperson ranch, Edwards County, at the end of the county road about 7.5 miles airline northeast of its intersection with State Highway 41, 12 miles east of intersection of U. S. Highway 377 and State Highway 41: large area of steeply dipping and collapsed nodular marl and miliolid biosparite of the Burt Ranch Member.

25. Upper reaches of Johnson Creek drainage on Kothmann ranch, Kerr County, about 2 miles west of intersection of U. S. Highway 290 and State Highway 27: 4 feet of fossiliferous Dr. Burt marl rests on 8 feet of thin-bedded miliolid biomicrite, biosparite, and porcellaneous micrite (upper Kirschberg); interface is a red-stained, regular surface; micrite breccia and coarse-crystalline travertine about 11 feet below contact.

27. On YO ranch about 3.3 miles airline west-northwest of ranch headquarters, Kerr County: calichified conglomerate beds at level of *Gryphaea* Bed on hillside 50 feet south of ranch road; no *Gryphaea* found.

29. On YO ranch about 4.5 miles west-southwest of ranch headquarters, Kerr County, about 0.5 mile due south of "Shearing Barn road": concentration of petrified wood, occurring as 1- to 4-foot lengths up to 12 inches in diameter; some segments occur close together and in long lines, suggesting a long broken tree trunk; wood occurs at two stratigraphic levels separated vertically by about 10 feet; probably about 60 to 80 feet above *Gryphaea* Bed; upper zone about 25 feet lower than hilltop; collected with Bobby Snow, Jr.

30. About 10 miles west of Mountain Home post office along graded road that turns south off State Highway 41 about 2 miles east of Black Bull ranch gate, Kerr County: *Gryphaea* Bed, but not in typical development; here *Gryphaea* shells are present in chert nodules; near south pinch-out of *Gryphaea* Bed.

31. Plowed field immediately northwest of Schultz ranch headquarters, Kerr County, about 10 miles west of Mountain Home and about 0.5 mile north of State Highway 41: rocks thrown out of field consist mostly of caliche but also include definite shelly Segovia; two or three pieces of *Exogyra arietina* coquina; soil is reddish-brown, no Black Bed found, though elevation (2,300 feet) suggests it should be here; probably a deep residual soil with remnants of overlying formations.

32. Caliche pit beside county road on Vossler ranch, Kerr County, about 10 miles airline west-southwest of Mountain Home: *Gryphaea* Bed in pit but completely dolomitized, with soft deeply weathered marl above, limestone with few *Gryphaea* below; near southeast limit of *Gryphaea* Bed.

33. Headquarters of C. R. Eddins ranch, Gillespie County, 2 miles west of Ranch Road 783, about 10 miles airline northwest of Kerrville: 100 feet west of ranchhouse is low outcrop of Allen Ranch Breccia at elevation 2,190 feet; also, just southeast of airstrip 1 mile southwest of ranch headquarters, 30 feet of miliolid lime sand above Kirschberg breccia, with marl slope above.

34. Top of bald hill (elevation 2,165 feet) roughly 10 miles airline northeast of Kerrville on old Kott ranch, Kerr County, just south of through ranch road between Center Point and Kerrville-Comfort roads: few pieces of Allen Ranch Breccia on top of hill.

35. South side of State Highway 1341 about 5 miles airline east of intersection of State Highways 16 and 1341 near Kerrville, Kerr County: low bluff with Glen Rose—Fort Terrett contact; boundary abruptly gradational, with 5 feet of yellowish-gray fossiliferous marl (*Exogyra texana*, *Cyprimeria* sp.) overlain by burrowed nodular limestone.

37. Caliche pit on Coke Stevenson ranch just south of graded county road, 1.5 miles west of its intersection with U. S. Highway 377, about 1.5 miles southwest of Telegraph, Kimble County: Fort Terrett—Burt Ranch contact exposed in pit; irregular blocks of porcellaneous micrite project up through marl; surface is bored, iron-stained, and has *Exogyra texana* cemented to surface; yellowish Dr. Burt marl above.

38. About 10 miles south of Telegraph, on west bank of Contrary Creek due west of windmill on Ed White—Bradford ranch, northeast Edwards County: excellent exposure shows Kirschberg breccia beneath sagging uppermost Fort Terrett beds, some of which pinch out on edges of sags; overlying

Burt Ranch Member is evenly bedded over deformed beds; this exposure demonstrates unequivocally that brecciation and deformation (caused by gypsum removal) was pre-Burt Ranch, *not* Pleistocene or Recent.

39. Beside road to Storms ranch, Kerr County, 3.5 miles airline south of Mountain Home post office: blocks of Allen Ranch Breccia.

40. In creek bed about 0.25 mile southeast of Roy Kemp ranch headquarters, Kerr County, about 4 miles airline southwest of Mountain Home: about 10 to 15 feet of massive, reefy, coarse-grained whole-fossil rudist limestone in lower part of Burt Ranch Member.

41. On YO ranch, 6 miles east of ranch headquarters and 0.5 mile north of main ranch road to Live Oak ranch, Kerr County: petrified wood on top of ridge about 500 yards southeast of windmill; one segmented log 24 feet long and 12 to 18 inches in diameter, plus many smaller fragments; about 80 feet above the *Gryphaea* Bed.

42. Along main northwest-southeast ranch road on Bobby French's South Fork ranch, Kerr County, 3 miles north of intersection of State Highways 39 and 187: reddish-brown silicified caprinid mound beside road.

43. About 1 mile west-northwest of locality 42, Kerr County: another silicified mound about 10 to 15 feet high, 100 feet in diameter.

44. About 1.5 miles northwest of locality 43 on French's South Fork ranch, Kerr County: topography is typical of *Gryphaea* Bed, but no *Gryphaea* were found; slabs of very coarse limestone-pebble conglomerate weather out of slope.

45. On State Highway 39, 9.9 miles west of Hunt, Kerr County: caliche pit in Burt Ranch marl with *Exogyra texana* underlain by about 10 feet of thin-bedded porcellaneous micrite and hard miliolid biosparite, underlain by about 5 feet of collapse breccia; Burt Ranch marl rests on stained and bored surface.

46. About 0.5 mile due north of Orgain's Pinto ranch headquarters, southwestern Kerr County, beside ranch road: collapse with patches of Del Rio, Buda, and Black Bed in disturbed area; one *Exogyra arietina* found, several distinct Black Bed nodules, bored, brownish-orange upper Segovia rock—but top of Segovia should be at least 60 feet higher than this; Indian mound beside large sink hole about 0.25 mile west.

47. In bluffs along draw about 1.5 miles east of Claude Haby ranch headquarters, northeastern Real County, about 3 miles east of U. S. Highway 83, and 12 miles north of Leakey: excellent exposure of upper Fort Terrett—Burt Ranch sequence.

48. At crossing of East Prong of Nueces River, 0.5 mile below (south of) Aubrey Clark house, northwestern Real County: equally spaced symmetric ripple marks 2 to 3 inches high, crest interval 1 to 2 feet, most oriented N. 80° E., a few opposed at right angles; rippled beds are mollusc-shell biosparite about 20 feet below altered zone of Kirschberg Evaporite.

49. On ranch road 0.5 mile north of Clark's "Last Chance" ranch headquarters, Kerr County, about 7 miles west-southwest of Hunt and south of State Highway 1340: sequence as follows:

	Thickness (feet)
Burt Ranch Member—	
6. Yellow, recessive marl	10.0
5. Massive, reefy limestone	4.0
4. Thin-bedded micrite, some incipient brecciation	4.0
3. Yellow marl interbedded with miliolid biosparite	10.0
Fort Terrett Formation—	
2. Thin-bedded porcellaneous micrite	9.0
1. Collapse breccia	not measured

50. New road cut on State Highway 1340, 1 mile west of MO-Ranch and 9.5 miles west of Hunt, Kerr County: fractured and shattered, brittle, dark dolomite and limestone beds of the Kirschberg that undulate as much as 2 feet and are overlain with angular unconformity by about 10 feet of upper Kirschberg thin-bedded lithographic micrite; 3 feet of soft yellow Burt Ranch marl at the top of the cut; this section demonstrates that the brecciation and disturbance, probably connected to Kirschberg gypsum removal, occurred in the Early Cretaceous, prior to deposition of Burt Ranch beds.

51. On Cullum ranch, Kerr County, about 8.5 miles airline west of Hunt on ranch road along Bee Caves Creek, 1.7 miles airline southeast of ranch headquarters: exposure of thin-bedded flaggy porcellaneous micrite, gradational upwards into Burt Ranch marl.

53. In immediate vicinity of Hugo Real barn, Kerr County, 10.5 miles airline west-southwest of downtown Kerrville: Kirschberg—Burt Ranch boundary zone, with severely collapsed porcellaneous micrite and a little miliolid biosparite, both as breccia and interlayered with marl; in upper part of Burt Ranch, perhaps 35 feet above base, there is a massive, partly silicified, reddish-weathering reefy bed about 5 feet thick that contains snails and caprinids.

54. About 150 yards northeast of Andy Reed ranch headquarters, Bandera County, on headwaters of Brewington Creek about 10 miles northwest of Medina: exceptionally clear Glen Rose—Fort Terrett boundary exposed in bluff:

	Thickness (feet)
Fort Terrett Formation—	
8. Nodular, massive, resistant biomicrite with scattered *Exogyra texana*	10.0+
7. Thin yellowish marl with abundant *Exogyra texana*	2.0
Glen Rose Formation—	
6. Blocky limestone with bored bedding surfaces and red-stained oysters	2.0
5. Thin-bedded silty micrite	2.0
4. Green clay	5.0
3. Resistant, blocky silty marl	4.0
2. White to cream clay	10.0
1. Thin-bedded silty dolomite	10.0

55. Along hairpin turn in old State Highway 187 (Station C road or old Sabinal Canyon road), northwestern Bandera County, about 9 miles north of Vanderpool: short section from Kirschberg breccia through Burt Ranch; important because of the occurrence of a bored surface near the base of the Burt Ranch but with about 5 feet of marly limestone still below it.

56. On hilltop about 0.75 mile airline east of L. Coffey ranchhouse about 2.5 miles north of Vanderpool, Bandera County: sequence as follows:

	Thickness (feet)
Burt Ranch Member—	
4. Hard resistant miliolid biosparite at top of hill	4.0
3. Soft yellow marl	15.0
2. Miliolid biosparite and *Toucasia* biomicrite	10.0
Fort Terrett Formation—	
1. Porcellaneous micrite breccia	4.0

Structurally quite high: Glen Rose top about 1,880 feet, base of Segovia about 2,190 feet.

57. Road cuts on State Highway 377, 8.5 miles by road east of Leakey, Real County: here are found a lower unit of poorly developed dolomitized breccias associated with cavernous recrystallized limestone overlain by an upper unit of thin (1 to 3 feet) yellowish-orange marls interbedded with massive rudist-shell and miliolid biosparite. The upper unit is probably equivalent to the Burt Ranch Member; a section should eventually be measured here.

58. About 0.5 mile due south of Ben Johnson ranchhouse, Bandera County, at headwaters of Mickle Creek, 8 miles west-northwest of Medina: sequence as follows:

	Thickness (feet)
Burt Ranch Member—	
4. Massive reefy rudist biomicrite and biosparite	30.0
3. Interbedded yellow flaky marl, porcellaneous micrite, and miliolid biosparite	20.0
Fort Terrett Formation—	
2. Porcellaneous micrite and micrite breccia	10.0
1. Altered travertine and crystalline limestone	30.0

59. About 8.5 miles west-southwest of Medina on Ned Adams ranch, Bandera County: lithoclast bed 5 feet above base of marl in Burt Ranch Member.

60. Hilltop 1.5 miles northeast of Duke ranch headquarters, Bandera County, about 8 miles northeast of Utopia: upper Fort Terrett—Burt Ranch sequence as follows:

	Thickness (feet)
Burt Ranch Member—	
5. Massive reefy *Toucasia* limestone	10.0+
4. Yellow fossiliferous marl with *Exogyra texana,* snails, heart clams	17.0
3. Thin-bedded porcellaneous micrite	5.0
2. Massive, reefy, porous miliolid biosparite and recrystallized limestone	30.0
Fort Terrett Formation—	
1. Porcellaneous micrite and breccia	3.0+

61. North-facing bluff on North Fork of Guadalupe River, Kerr County, about 11 miles west of Hunt: large-scale, gently east-dipping accretion beds or possibly drape in middle reefy zone of Burt Ranch, with thin yellowish marl just below; compare with similar zone in nearby North Fork composite section.

62. Caliche pit on L. A. Real ranch, Kerr County, 1.8 miles airline west of ranch headquarters and about 11 miles airline southwest of Kerrville; sequence as follows:

	Thickness (feet)
Burt Ranch Member—	
5. Nodular marl that forms a bench	15.0
4. Reefy biomicrite with radiolite fragments and other shell debris	18.0
3. Yellowish-gray nodular marl	20.0
Fort Terrett Formation—	
2. Porcellaneous micrite and hard miliolid biosparite	20.0
1. Porous travertine and recrystallized limestone	10.0+

Only 1.5 miles south of locality 62 is the Louis Real section, where unit 3 is thin, with little marl, and unit 4 is a massive rudist reef more than 30 feet thick.

63. Quarries on north side of State Highway 1273, 5.4 miles northwest by road from its intersection with State Highway 16, and about 9 miles southwest of Kerrville, Kerr County: interbedded porcellaneous micrite and marl in lowermost Burt Ranch; this section demonstrates that the porcellaneous micrite occurs sometimes above the marl.

64. East side of Johnson Creek, 0.25 mile upstream from Sunset cemetery on Tex Philly ranch, Kerr County, about 1 mile south of Mountain Home: about 200 yards north of low-water crossing is clear exposure of Glen Rose—Fort Terrett boundary, with yellow oyster clay of basal Fort Terrett on grayish-brown silty clay of Glen Rose; cracks 2 to 6 inches long that extend down into the Glen Rose apparently are filled with overlying *Exogyra texana* clay of basal Fort Terrett.

65. Road cuts along U. S. Highway 83, 11 miles north of Leakey and just south of roadside park at Horsecollar Bluff, Real County: Burt Ranch section apparently correlates with Vanderpool, West Frio, and Bee Caves Ranch sections; dolomite beds above Burt Ranch are the same dolomite beds just above the Burt Ranch at Joy Creek; near top of hill is thick breccia section—probably Allen Ranch Breccia.

66. On Rose ranch, Kimble County, about 8 miles airline west of Telegraph: interval measured from *Gryphaea* Bed to Buda, about 135 feet; Black Bed about 21 feet below Buda.

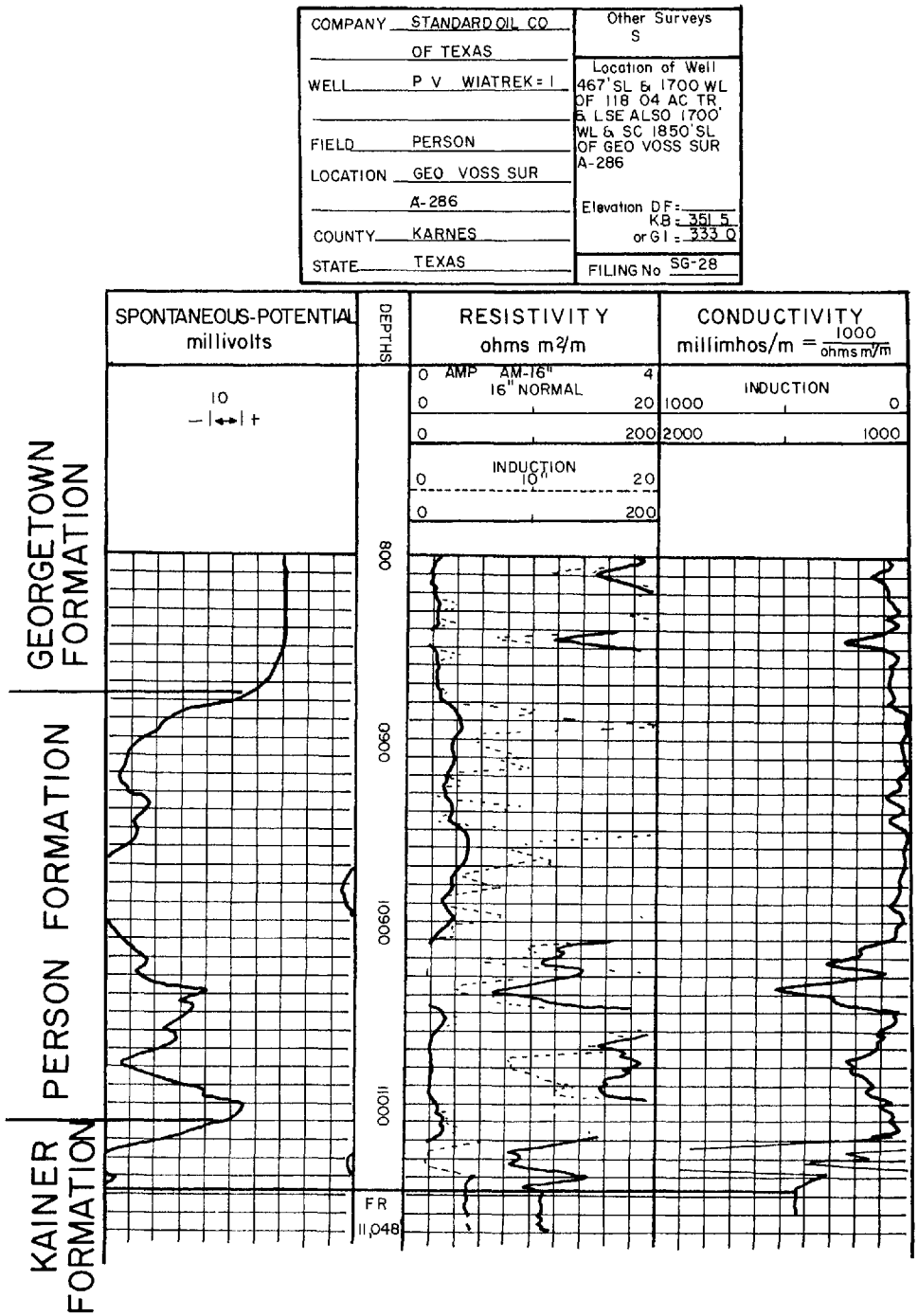
67. Quarry about 100 yards west of U. S. Highway 377, about 1 mile southwest of bridge crossing of South Llano River, northeastern Edwards County, about 10 miles by road southwest of Telegraph: floor of quarry is red-stained resistant wackestone with "bored borings" near the base of the Burt Ranch Member, here about 50 feet thick.

68. Quarries about ¼ mile southwest of Garven Store on Will Auld ranch, extreme northeast Real County: distinct erosion surface developed above Black Bed, with cracks and fissures in the underlying micritic limestone filled by overlying tan calcarenite that contains pebbles of Black Bed; also root holes (or borings?) in the Black Bed; compare with locality 16.

69. Outcrops about ½ mile east of U. S. Highway 83 beside paved ranch road leading to Will Auld ranch headquarters, extreme southwestern Kerr County, about 2 miles south of Garven Store: very large rounded blocks of Black Bed, some bored, crop out on either side of the road; Black Bed occurs as rounded cobbles in tan calcarenite of locality 68; measured interval from Black Bed to Del Rio very small in this vicinity, 2 to 5 feet.

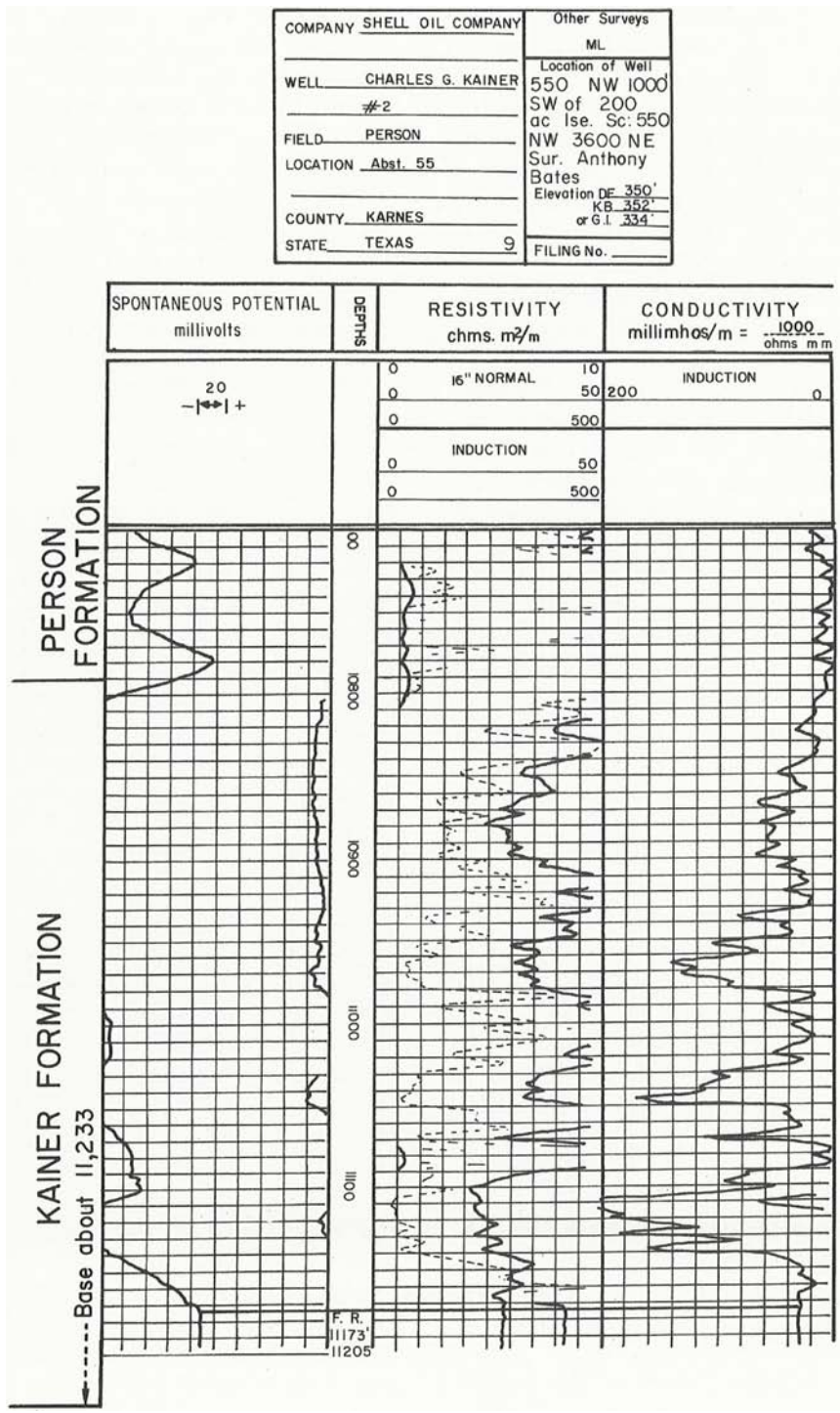
APPENDIX E

TYPE LOG: PERSON FORMATION



APPENDIX E

TYPE LOG: KAINER FORMATION



APPENDIX F

FREDERICKSBURG-WASHITA RELATIONS IN THE MAVERICK BASIN

This part of the report is a synthesis of work by Imlay (1945), Winter (1961a, 1962), Lozo and Smith (1964), Smith (1966, 1970), and the writer, and is presented as a means of summarizing presently held concepts of the Maverick basin succession, lithologies, and depositional environments for reference and comparison in other parts of this paper.

The isopachous map units of the Maverick basin require a brief explanation. Winter and this writer believe the uppermost McKnight to be the same as the Regional Dense Member of the Person Formation. Accordingly, the Maverick basin equivalent of the Kainer Formation (fig. 16) includes the West Nueces and all but the upper 30 to 70 feet of the McKnight; the rock mapped with the Person Formation (fig. 17) includes therefore the uppermost McKnight and Pryor Member; and the Maverick basin equivalent of the Georgetown of the San Marcos Platform is all the Salmon Peak above the Pryor. These boundaries are indicated on the electric log correlation sections by heavier lines. Del Rio and Buda are continuous from basin to platform and require no explanation.

West Nueces Formation.—Light-gray, miliolid and mollusc-fragment biomicrite and biosparite constitute the West Nueces Formation, which rests conformably upon the Glen Rose. It is about 150 to 200 feet thick and thickens at the expense of the overlying McKnight Formation toward the margins of the Maverick basin. To the north and east it grades laterally into Devils River. Environment of deposition was shallow marine, restricted to open circulation, low to moderate current energy.

McKnight Formation.—Black, thin-bedded, argillaceous micrite with anhydrite interbeds, nodules, or veins is characteristic of the McKnight Formation. Collapse breccia is found at the outcrop and in the shallow subsurface at the stratigraphic level of deeper subsurface anhydrite beds. Thin beds of salt have been reported in some wells. According to Winter, the McKnight attains a maximum thickness of slightly more than 500 feet along the southwestern margin of the Maverick basin, in central Dimmit County, but it is 200 to 400 feet thick over much of the basin and thins to zero at the basin margins, intertonguing with the upper part of the Kainer Formation of the Edwards Group. The McKnight is conformable with and intertongues with the West Nueces Formation (Pl. 3, E).

Smith (1966, p. 101) has described the depositional environment of the McKnight as a restricted euxinic back-reef lagoon. The writer concurs and suggests that the lagoon may have been on the order of 50 to 150 feet deep, where calm waters, depth, and high salinity gradient might have combined to produce the even bedding, euxinic bottom conditions and bedded anhydrite typical of the McKnight. Although even laminations and anhydrite may suggest tidal flat deposition to some, there are examples of what appear to be bedded anhydrite in basin deposits, such as the Permian Castile Formation in the Delaware Basin, western Texas and eastern New Mexico. Furthermore, the stromatolitic crusts, mud cracks, and common exposure surfaces so characteristic of known Edwards tidal flat rocks on the San Marcos Platform are almost unknown in the McKnight.

Salmon Peak Formation.—At the type section along the northern margin of the Maverick basin the Salmon Peak consists of 380 feet of light-gray, thick-bedded *Globigerina* biomicrite overlain by 75 feet of well-sorted mollusc-fragment biosparite (Lozo and Smith, 1964). The lower unit is the Pryor Member of Winter (1961b); it thins to the south and east so that it is less than 200 feet thick along the eastern edge of the basin. Around the basin margins, the upper unit is the Upper Grainstone of Lozo and Smith (1964), which grades into *Globigerina* biomicrite passing into the basin. Although the Salmon Peak and McKnight are separated by a disconformity at the type locality (Lozo and Smith, 1964, p. 303) the writer suspects they are conformable over most of the Maverick basin. Environment of deposition of the Salmon Peak is interpreted as open shelf, moderately deep water, low to moderate wave and current energy.

Winter (1962, p. 92) designated the Cannon No. 1 Finley, Zavala County (not located on Plate 2), as type well for his Pryor Member. His description of the samples from the 302-foot type section includes two intervals containing anhydrite. In the writer's opinion, this reported anhydrite is not characteristic of the Pryor Member in the Maverick basin.

Del Rio Clay.—The Del Rio of the eastern Maverick basin and of the San Marcos Platform are lithically the same, but the formation thickens from 50 feet on the platform to more than 250 feet in the basin in southwestern Zavala County. Depositional environment is open shelf, moderately deep water, low wave and current energy. Upper and

lower boundaries are conformable in the basin but are disconformable along the northern edge of the basin (Lozo and Smith, 1964, p. 303).

Buda Limestone.—The Buda Limestone is lithically the same as it is on the San Marcos Platform: light-gray micrite with microspherulites, scattered pelagic Foraminifera, and fragile mollusc fragments. It is 100 to 120 feet thick along the east side of the Maverick basin and thickens to more than 160 feet in southwestern Zavala County. Depositional environment is interpreted as open shelf, moderate water depth, low wave and current energy.

APPENDIX G

QUANTITATIVE ANALYSIS OF REFLUX HYPOTHESIS FOR DOLOMITIZATION OF MASSIVE-MUDDY EDWARDS DOLOMITES

(1) According to Pettijohn (1957, p. 87) permeability may be expressed as: $Q = \frac{FP}{ML}$ where Q is velocity of flow in cm^3/sec through a cylindrical rock specimen of cross section F(in cm^2) and length L(cm). P represents the pressure difference in atmospheres and M is the viscosity of the fluid in centipoises. K represents permeability in darcys.

(2) It is assumed that the permeability of the sediment under consideration did not exceed about 200 millidarcies, and probably was much less. Secondly, regional stratigraphic relations preclude topographic relief of the sea floor in excess of about 20 meters, so that, assuming a density difference of 10% between the hypothetical dolomitizing waters and normal sea water, a pressure differential of 0.2 atmospheres seems reasonable. The horizontal distance traveled by the dolomitizing fluids ranges greatly, but the extent of this type of dolomite, and of the hypothesized Kirschberg lagoon, exceeds 100 km. Nevertheless, let us select 50 km as a reasonable figure for lateral flow distance. Viscosity of sea water having salinity of 200 ppt at 30° C (typical of dolomitizing waters of Bonaire and the Persian Gulf) is calculated to be about 1.2 centipoises. Cross section of rock to be dolomitized is assumed as 1 cm^2. Accordingly, the flow rate of such hypersaline waters through a cylindrical rock body is calculated as:

$$\frac{2 \times 10^{-1} \text{ d.} \cdot 1 \text{ cm}^2 \cdot 2 \times 10^{-1} \text{ atm.}}{1.2 \text{ cp} \cdot 5 \times 10^{6} \text{ cm}} = 6.7 \times 10^{-9} \text{ cm}^3/\text{sec.}$$

(3) Now it is necessary to calculate the volume of hypersaline sea water that could have moved through such a rock body in the maximum allowable time. The Early Cretaceous lasted about 32 to 35 million years, and if we assume the Neocomian, Aptian, and Albian were roughly equal, 12 million years seems reasonable for the Albian. By similar reasoning, the duration of Fredericksburg time may be estimated as 5 million years. Thickness of the rock interval claimed to have been produced by reflux is approximately 1/4, and the thickness of the Kirschberg Evaporite probably did not exceed 1/8, of the total Fredericksburg, so the time available for reflux can be estimated as 1 million years, or about 3×10^{13} sec. Accordingly, the volume of hypersaline sea water moved through the rock cylinder could not have exceeded:

6.7×10^{-9} $cm^3/sec \cdot 3 \times 10^{13}$ sec $= 2.0 \times 10^{5}$ cm^3.

(4) Salinities of modern dolomitizing waters from the Persian Gulf and Bonaire average about 200 ppt, and Mg/Ca ratios of 20/1 are characteristic, indicating concentration perhaps seven times normal. Concentration of magnesium in normal sea water is 1.35×10^{-3} gm/cm^3, so magnesium concentration in the hypothetical dolomitizing brine may be estimated as 1×10^{-2} gm/cm^3. Accordingly, the amount of magnesium that could be introduced by reflux into the hypothetical sediment body in the time available was on the order of:

2.0×10^{5} $cm^3 \cdot 1 \times 10^{-2}$ gm/cm^3 $= 2 \times 10^{3}$ gm.

(5) Volume of the limestone mass under consideration is 5×10^{6} cm^3. If initial porosity of the unindurated sediment was 50%, the total volume of $CaCO_3$ was 2.5×10^{6} cm^3, of which about 13% is to be replaced by magnesium, the density of which is 2.85. Let us assume that only 50% of the available $CaCO_3$ is dolomitized. Thus, the amount of magnesium in the hypothetical sediment body after it is dolomitized is:

2.5×10^{6} $cm^3 \cdot 0.13 \times 2.85$ gm/$cm^3 \cdot 0.5 = 4.6 \times 10^{5}$ gm.

(6) Clearly, the amount of magnesium available in the refluxing brines is insufficient by more than two orders of magnitude to account for even 50% dolomitization at 100% "dolomitizing efficiency" ($2 + 10^3$ gm vs. $4.6 + 10^5$ gm).

COMANCHE SERIES

FREDERICKSBURG DIVISION

EDWARDS GROUP

Kainer Formation

WASH DIV

Person Fm.

TRIN-ITY

GLEN ROSE

LITHIC DESCRIPTION

Grainstone Member

Limestone: light to medium brown, generally medium-grained, well sorted, current laminated, miliolid intrasparite; I/IIIA/B; many clasts are coated aggregates; some micrite matrix, many clasts and miliolids altered to microspar; few streaks of larger mollusc shells: Toucasia, radiolites, oysters; scattered dolomitic streaks in lower 30 to 40 feet; few calcite pseudomorphs after anhydrite nodules; upper boundary may be disconformable

Environment: open shallow marine, moderate to high wave- and current-energy

Dolomitic Member

Dolomitic limestone: medium to dark brownish gray, burrowed, fine- to medium-grained, moderately sorted, miliolid biosparite and intrasparite; IIIA/B; clasts are soft pellets, stromatolitic hard crusts, and coated aggregates; other features:

--from about 40 feet to about 150 feet below top of unit occur stromatolite crusts, collapse structures, wispy burrowed intertidal micrite, anhydrite nodules and anhydrite-filled cracks, and layered celestite

--in lower 120 feet of bed, dolomite and supratidal features decrease somewhat as unit becomes darker gray, more micritic and argillaceous, with increasing anhydrite across Edwards-Glen Rose boundary

Upper and lower boundaries both transitional

Environment: intertidal to open shallow marine, general low wave- and current-energy

GLEN ROSE FORMATION

Dolomitic limestone: dark-gray, compact, argillaceous, anhydritic dolomitic micrite; IIIA.

DEPOSITIONAL ENVIRONMENTS

SUPRATIDAL

INTERTIDAL

SHALLOW MARINE RESTRICTED

SHALLOW MARINE OPEN

OPEN SHELF

INDUCTION LOG

GRAINSTONE MBR.

DOLOMITIC MBR.

Kainer Formation

GLEN ROSE

LITHIC LOG

DOLOMITE CONTENT

DOLOMITIC LIMESTONE

CALCITIC DOLOMITE

DOLOMITE

SONIC LOG

APPROXIMATE POROSITY

15% 10% 6%

400′ 380′ 360′ 340′ 320′ 300′ 280′ 260′ 240′ 220′ 200′ 180′ 160′ 140′ 120′ 100′ 80′ 60′ 40′ 20′ 0′

LEGEND

A. SKELETAL PARTICLES

Forams

- miliolids
- Orbitolina
- Globigerina
- Dictyoconus

Corals

- Cladophyllia
- colonial mass

Algae

- dasyclad stalk
- calcispheres
- stromatoporoid

Molluscs

- caprinid
- snail
- radiolite
- oysters
- Toucasia
- small flat clams
- Chondrodonta

B. MINERAL CONSTITUENTS

- carbonaceous streak
- sparry calcite
- chert nodule
- celestite
- disseminated chert
- gypsum-anhydrite
- pyrite

C. SEDIMENTARY STRUCTURES

- burrows
- soft-mud lumps
- wispy structure
- rock fragments
- pellets
- hardcrust or stromatolitic layer

D. DIAGENETIC STRUCTURES

- collapse structure, spar-filled
- collapse structure, mud-filled (or channel conglomerate?)
- spar-filled fracture
- spar-filled anhydrite nodule

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FIG. 9. Generalized columnar section, Fredericksburg Division, Fashing-Person trend, south-central Texas.

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GULF SERIES

COMANCHE SERIES

WASHITA DIVISION

EDWARDS GROUP

FREDS. DIV.

Eagle Ford Formation	Person Formation	Kainer Fm
Buda Limestone		
Del Rio Clay		
Georgetown Formation		
	Cyclic Member	
	Marine Member	
	Leached Member	
	Collapsed Member	
	Regional Dense Member	

LITHIC DESCRIPTION

BUDA LIMESTONE
Argillaceous limestone: medium grayish-brown, hard, compact, slightly pyritic, in part argillaceous micrite; IA; scattered burrows and shaly streaks; Globigerina, calcispheres and fragile mollusc shells in streaks; upper boundary abrupt, probably conformable
Environment: open shelf

DEL RIO CLAY
Calcareous shale: very dark brownish-gray, hard, compact, granular, wispy, carbonaceous, pyritic calcareous shale; IA; not notably fissile; few Globigerina, small fragile clams; upper boundary gradational in most places
Environment: open shelf

GEORGETOWN FORMATION
Limestone: medium- to dark-gray, hard, compact, burrowed, wispy, slightly argillaceous micrite; IA; common streaks rich in Globigerina, calcispheres, fragile mollusc shells; also very carbonaceous streaks; scattered pyrite; a few clasts of Georgetown lithology, particularly near base and rare stromatoporoid masses; upper boundary gradational
Environment: open shelf

Cyclic Member
Limestone and dolomitic limestone: medium to dark gray and brown, burrowed, wispy intramicrite and mollusc biomicrite, in part dolomitic; I/IIIA/B; micrite matrix altered partly to microspar; intraclasts are broken stromatolitic crusts and soft-mud lumps, common skeletal fragments are Toucasia, caprinids, radiolites, oysters, snails, Cladophyllia, miliolids, Orbitolina, Dictyoconus; many shells have been leached and later filled in with sparry calcite; few thin collapsed zones; black chert nodules near base of bed
Upper boundary is abrupt, irregular, with truncated shells and fractures, caves filled with Georgetown-type rock and angular Edwards-type lithoclasts; soil zone at boundary in two cores
Environment: restricted shallow marine to intertidal cycles with few supratidal layers and exposure surfaces at tops of cycles

Marine Member
Limestone: medium brown, wispy, medium- to coarse-grained mollusc biosparite and biomicrite; I/IIIA/B; micrite matrix partly altered to microspar; skeletal components occur whole or as sand-sized fragments: Chondrodonta, Toucasia, caprinids, radiolites, snails, small oysters, Cladophyllia, colonial coral masses; dasyclad algae, Dictyoconus; much shell material has been dissolved and voids later filled with sparry calcite; scattered small patches of blue-gray chalcedony replace shell; chert nodules in upper part; distinct current streaks and cross-bedding; becomes darker, finer grained in bottom 3 feet; upper boundary transitional
Environment: open shallow marine, moderate wave- and current-energy

Leached Member
Dolomite: light to medium brownish gray, massive, burrowed, wispy, fine-grained, fine- to medium-crystalline, dolomitized pelleted mollusc-fragment micrite and biomicrite; IIIB; sparry calcite pseudomorphs after gypsum crystals and nodules, also some spar-filled collapse cracks; upper boundary transitional
Environment: intertidal to restricted shallow marine, with history of early dolomitization and leaching of calcite

Collapsed Member
Dolomite and dolomitic limestone: dark brown and medium gray, very coarse-grained collapse breccia and pelleted mollusc biomicrite; IIIA/C; lithoclasts composed of broken stromatolitic crusts, laminated micrite, leached dolomite, soft mud lumps; upper part with spar-filled collapse cracks and calcite pseudomorphs after gypsum; upper boundary conformable
Environment: cyclic supratidal, intertidal, and restricted shallow marine with some rock exposed and leached subsequently

Regional Dense Member
Argillaceous limestone: dark brownish gray, hard, compact, wispy, pyritic argillaceous micrite; IA; scattered pellets and small oysters; in lower 6 to 8 feet miliolids and composite clasts become more abundant downward; in basal 2 feet rock is rotten, granular, very wispy, carbonaceous and pyritic; upper boundary transitional
Environment: open shallow marine, very low wave- and current-energy

DEPOSITIONAL ENVIRONMENTS

SUPRATIDAL | INTERTIDAL | SHALLOW MARINE RESTRICTED | SHALLOW MARINE OPEN | OPEN SHELF

INDUCTION LOG

Buda | Del Rio | Georgetown | CYCLIC MEMBER | MARINE MEMBER | LEACHED MEMBER | COLLAPSED MEMBER | REGIONAL DENSE MEMBER | Person Formation | Kainer Formation

LITHIC LOG

DOLOMITE CONTENT

DOLOMITIC LIMESTONE | CALCITIC DOLOMITE | DOLOMITE

SONIC LOG
APPROXIMATE POROSITY
15% 10% 6%

400′ 380′ 360′ 340′ 320′ 300′ 280′ 260′ 240′ 220′ 200′ 180′ 160′ 140′ 120′ 100′ 80′ 60′ 40′ 20′ 0′

LEGEND

A. SKELETAL PARTICLES

Forams
- miliolids
- Globigerina
- Orbitolina
- Dictyoconus

Corals
- Cladophyllia
- colonial mass

Algae
- dasyclad stalk
- calcispheres
- stromatoporoid

Molluscs
- caprinid
- radiolite
- Toucasia
- Chondrodonta
- snail
- oysters
- small flat clams

B. MINERAL CONSTITUENTS
- carbonaceous streak
- chert nodule
- disseminated chert
- pyrite
- sparry calcite
- celestite
- gypsum-anhydrite

C. SEDIMENTARY STRUCTURES
- burrows
- wispy structure
- pellets
- soft-mud lumps
- rock fragments
- hardcrust or stromatolitic layer

D. DIAGENETIC STRUCTURES
- collapse structure, spar-filled
- collapse structure, mud-filled (or channel conglomerate?)
- spar-filled fracture
- spar-filled anhydrite nodule

FIG. 10. Generalized columnar section, Washita Division, Fashing-Person trend, south-central Texas.

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ROCK UNITS MAPPED

MAVERICK BASIN		SAN MARCOS PLATFORM	NORTH TEXAS-TYLER BASIN
lower McKNIGHT FM. / WEST NUECES FORMATION	lower DEVILS RIVER FM.	KAINER FORMATION OF EDWARDS GROUP	EDWARDS FORMATION / COMANCHE PEAK FM. / WALNUT FORMATION

EXPLANATION

- 15₀ Electric log and well index number
- • Electric log and samples studied by Rose
- W• Samples studied by Winter (1961 b)
- T• Samples studied by Tucker (1962 a)
- △ Electric log and core studied by Rose
- 5/ Measured section and segments
- ⌒ % of mapped interval that is dolomitic

Base of Edwards after Rodda et al. (1966) and Rose (1968)

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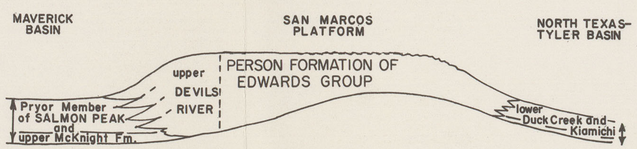
FIG. 14. Isopachous map of Kainer Formation and equivalent rocks.

SCALE 0 10 20 30 40 MILES

ISOPACHOUS CONTOUR INTERVAL 20 FEET

ROCK UNITS MAPPED



EXPLANATION

- 15₀ Electric log and well index number
- • Electric log and samples studied by Rose
- W• Samples studied by Winter (1961 b)
- T• Samples studied by Tucker (1962 a)
- ▲ Electric log and core studied by Rose
- 5/ Measured section and segments
- ⌒ % of mapped interval that is dolomitic

Base of Edwards after Rodda et al. (1966) and Rose (1968)

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SCALE 0 10 20 30 40 MILES

ISOPACHOUS CONTOUR INTERVAL 20 FEET

FIG. 15. Isopachous map of Person Formation and equivalent rocks.

ROCK UNITS MAPPED

EXPLANATION
15• Electric log and well index number
• Electric log and samples studied by Rose
W• Samples studied by Winter (1961 b)
T• Samples studied by Tucker (1962 a)
Electric log and core studied by Rose
5/ Measured section and segments
Base of Edwards after Rodda et al. (1966) and Rose (1968)
STUART CITY TREND
KARNES TROUGH
DEVILS RIVER UPLIFT
SAN MARCOS ARCH
LULING-MEXIA-BIRCH CREEK UPLIFT
MARYNEAL REEF
MAVERICK BASIN
SAN MARCOS PLATFORM
NORTH TEXAS-TYLER BASIN
UVALDE CO
MEDINA CO
BANDERA CO
BEXAR CO
KERR CO
FRIO CO
ATASCOSA CO
MCMULLEN CO
KARNES CO
WILSON CO
GUADALUPE CO
CALDWELL CO
HAYS CO
TRAVIS CO
WILLIAMSON CO
BASTROP CO
LEE CO
BURLESON CO
MILAM CO
BELL CO
WASHINGTON CO
FAYETTE CO
GONZALES CO
LAVACA CO
DE WITT CO
Uvalde
Sabinal
Hondo
Medina
San Antonio
Pearsall
Dilley
Poteet
Floresville
Karnes City
Kenedy
Seguin
New Braunfels
San Marcos
Lockhart
Luling
Bastrop
Austin
Georgetown
Rockdale
Giddings
La Grange
Gonzales
Cuero
Yoakum
Hallettsville
Edwards
Nueces
Frio
Atascosa
Medina
Blanco
Colorado River
Guadalupe
Sabinal River
Hondo Creek
Chacon Creek
Escondido Creek
Arroyo Seco
Sandies Creek
Peach Creek
Brushy Creek
Cibolo Creek
Sandies Creek
Escondido Creek
Lytle
Devine
Natalia
Somerset
Von Ormy
Elmendorf
Converse
Schertz
Cibolo
Boerne
Comfort
Kendalia
Spring Branch
Bulverde
Helotes
Leon Springs
Fair Oaks Ranch
Stone Oak
Alamo Heights
Terrell Hills
Olmos Park
Castle Hills
Windcrest
Kirby
Live Oak
Universal City
Randolph AFB
Selma
Schertz
Cibolo
Marion
Santa Clara
Geronimo
Nixon
Smiley
Gillett
Runge
Karnes City
Falls City
Panna Maria
Kosciusko
Stockdale
Floresville
Poth
Somerset
Pleasanton
Jourdanton
Christine
Charlotte
Moore
Derby
Dilley
Asherton
Crystal City
Carrizo Springs
Zavala
Dimmit
Maverick
Webb
Frio
Atascosa
McMullen
La Salle
Duval
Live Oak
Bee
Goliad
Refugio
Victoria
Calhoun
Jackson
Matagorda
Wharton
Colorado
Fayette
Lavaca
Gonzales
Caldwell
Guadalupe
Comal
Kendall
Bandera
Kerr
Real
Edwards
Kinney
Maverick
Zavala
Dimmit
La Salle
Uvalde
Medina
Bexar
Wilson
Karnes
DeWitt
Lavaca
Colorado
Jackson
Matagorda
Wharton
Fort Bend
Waller
Harris
Montgomery
Liberty
Chambers
Galveston
Brazoria
Hardin
Jefferson
Orange
Newton
Sabine
San Augustine
Shelby
Panola
Rusk
Cherokee
Anderson
Houston
Trinity
Polk
San Jacinto
Walker
Grimes
Brazos
Burleson
Lee
Washington
Austin
Waller
Fort Bend
Harris
Montgomery
Liberty
Chambers
Galveston
Brazoria
Hardin
Jefferson
Orange
Newton
Sabine
San Augustine
Shelby
Panola
Rusk
Cherokee
Anderson
Houston
Trinity
Polk
San Jacinto
Walker
Grimes
Brazos
Burleson
Lee
Washington
Austin
Colorado
Fayette
Lavaca
Gonzales
Caldwell
Guadalupe
Comal
Kendall
Bandera
Kerr
Real
Edwards
Kinney
Maverick
Zavala
Dimmit
La Salle
Uvalde
Medina
Bexar
Wilson
Karnes
DeWitt
Lavaca
Colorado
Jackson
Matagorda
Wharton
Fort Bend
Waller

FIG. 17. Isopachous map of Del Rio Clay.

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FIG. 18. Isopachous map of Buda Limestone.

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COMANCHE SERIES

EDWARDS GROUP

Fort Terrett Formation

Segovia Formation

	LITHIC DESCRIPTION
BURT RANCH MEMBER	Burt Ranch Member Marly limestone and bioclastic limestone: light yellowish gray, thin-bedded to massive, nodular, wispy, whole-mollusc marly micrite; thin-bedded miliolid biomicrite and biosparite; and massive whole-rudist biomicrite; fossiliferous marl most common at base and top, contains Exogyra texana, Lunatia, Enallaster, Cyprimeria, heart clams, rare oxytropidocerid ammonites; base of interval is a bored surface locally; bored surfaces also occur a few feet above base and in middle of unit; lower marly interval is Dr. Burt zone Environment: open shallow marine, variable wave- and current-energy
KIRSCHBERG EVAPORITE	Kirschberg Evaporite Crystalline limestone, collapse breccia, gypsum and porcellaneous limestone: pink to gray, medium- to coarse-crystalline, massive- to thin-bedded, cherty, crystalline limestone and travertine containing intervals of limestone-, dolomite-, and chert fragment collapse breccia, overlain by light-gray, thin-bedded brittle porcellaneous to lithographic micrite, commonly collapsed and brecciated; in northern Gillespie County interval contains massive gray gypsum; upper boundary conformable, ranges from gradational to abrupt Environment: restricted shallow marine, low wave- and current-energy in part highly restricted and evaporitic to sabkha-type evaporitic supratidal and intertidal
DOLOMITIC MBR.	Dolomitic Member Dolomite: light to medium gray, thin-bedded to massive, fine- to medium-crystalline, dolomitized micrite and mollusc-fragment biomicrite; irregular chert nodules scattered throughout; scattered possible hard crusts, flat clasts, disrupted zones, calcite pseudomorphs after gypsum nodules; some thin beds of miliolid biosparite intimately interbedded with dolomite; rudist biostromes at base in some places Environment: intertidal to restricted shallow marine with a little possible supratidal; generally low wave- and current-energy
BURROWED MBR.	Burrowed Member Limestone: light gray, massive, resistant, porous, burrowed, nodular mollusc biomicrite; some even thin beds of miliolid and mollusc-fragment biosparite above, rippled and cross-bedded in part, few thin dolomite interbeds; upper boundary transitional Environment: restricted to open shallow marine, low wave- and current-energy
BASAL NODULAR MBR.	Basal Nodular Member Marl and marly limestone: light yellowish gray, soft, recessive, nodular oyster marl grading upward to whole mollusc biomicrite; sandy and silty in lower half in some places; common fossils are Exogyra texana, Lunatia, turritellid snails, protocardid clams; lower boundary generally abrupt, in many places red stained, irregular, bored, plastered with oysters, probably disconformable; upper boundary gradational Environment: open shallow marine, low wave- and current-energy
GLEN ROSE FORMATION	GLEN ROSE FORMATION Marl, argillaceous limestone and dolomite: yellowish-gray to grayish-brown alternating beds of nodular to homogeneous calcareous clay, argillaceous micrite, and burrowed, fine-crystalline dolomite; some silty streaks; scattered oysters Environment: intertidal to restricted shallow marine, low wave- and current-energy

DEPOSITIONAL ENVIRONMENTS: SUPRATIDAL; INTERTIDAL; SHALLOW MARINE RESTRICTED; SHALLOW MARINE OPEN; OPEN SHELF

LITHIC LOG: 300′, 280′, 260′, 240′, 220, 200′, 180′, 160′, 140′, 120′, 100′, 80′, 60′, 40′, 20′, 0′, 20, 40

DOLOMITE CONTENT: DOLOMITIC LIMESTONE; CALCITIC DOLOMITE; DOLOMITE

LEGEND

A. SKELETAL PARTICLES

Foraminifera

miliolids; Orbitolina; Globigerina; Dictyoconus

Corals

Cladophyllia; colonial mass

Algae

dasyclad stalk; calcispheres; stromatoporoid

Molluscs

caprinid; snail; radiolite; oysters; Toucasia; small flat clams; Chondrodonta; heart clams

B. MINERAL CONSTITUENTS

carbonaceous streak; sparry calcite; unidentified allochems; chert nodule; celestite; dolomite; disseminated chert; gypsum-anhydrite; pyrite; quartz sand

C. SEDIMENTARY STRUCTURES

burrows; cross-bedding; bored surface; wispy, nodular; rock fragments; ripple marks; hardcrust or stromatolitic layer

D. DIAGENETIC STRUCTURES

collapse structure, spar-filled; pulverulite; collapse structure, mud-filled (or channel conglomerate?); travertine; spar-filled anhydrite nodule; spar-filled fracture

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FIG. 22. Generalized columnar section, Fort Terrett Formation, eastern Edwards Plateau, Central Texas.

COMANCHE SERIES

EDWARDS GROUP

Segovia Formation

Buda Limestone

Del Rio Clay

BLACK BED

ORR RANCH BED

GRYPHAEA BED

ALLEN RANCH BRECCIA

BURT RANCH MBR

Fort Terrett Formation

KIRSCHBERG EVAPORITE

LITHIC DESCRIPTION

BUDA LIMESTONE
Limestone and marl; yellowish-gray, hard, nodular micrite and mollusc biomicrite; and soft, recessive nodular marly micrite; lower boundary disconformable
Environment: open shallow marine to open shelf, low wave- and current-energy

Marl: yellowish-brown, soft, nodular, silty, calcareous clay with abundant Exogyra arietina
Environment: open shallow marine to open shelf, low wave- and current-energy

Limestone and marl: light gray, medium bedded to massive, resistant, medium- to coarse-grained miliolid and mollusc-fragment biosparite with scattered rudists; and recessive, generally thin interbeds of calichified marl; upper contact abrupt, bored, probably disconformable; near top of unit nodules of black to dark-gray micrite weather out of a prominent covered slope below a rounded resistant ledge of biosparite (=Black Bed); base of this ledge is probable disconformity
Environment: open shallow marine, moderate to high wave- and current-energy

Crystalline limestone, dolomite, and caliche: light-gray, soft, deeply weathered and altered, fine- to coarse-crystalline limestone, locally dolomitized; weathers to a distinctive open grassy slope (= Orr Ranch Bed); petrified wood and chert nodules commonly weather out of slope
Environment: unknown, possibly restricted shallow marine

Limestone and dolmite: light-gray, resistant, poorly-sorted, medium- to coarse-grain, rudist biosparite (= caprinid zone); dolomitized in part; fossils occur as abraded fragments and as whole caprinids, Toucasia, Chondrondonta; locally silicified
Environment: open shallow marine, moderate to high wave- and current-energy

Dolomitic limestone and marl: light grayish-brown, soft, recessive, nodular and burrowed in part, dolomitized micrite and marl; contains one or more resistant beds of whole-oyster biomicrite with abundant silicified Gryphaea (= Gryphaea Bed)
Environment: restricted shallow marine, low wave- and current-energy

Dolomite, limestone, and collapse breccia: brownish-gray, thin- to thick-bedded, medium-crystalline, homogeneous dolomite interbedded with light-gray, brittle, siliceous micrite; locally collapsed (= Allen Ranch Breccia)
Environment: intertidal to restricted shallow marine, low wave- and current-energy

Burt Ranch Member
Marly limestone and bioclastic limestone: light yellowish gray, thin-bedded to massive, nodular, wispy, whole mollusc marly micrite; thin-bedded miliolid biomicrite and biosparite, and massive whole rudist biomicrite; fossiliferous marl most common at base and top, contains Exogyra texana, Lunatia, Enallaster, Cyprimeria, heart clams, rare oxytropidoceriid ammonites; base of interval is a bored surface locally; bored surfaces also occur a few feet above base and in middle of unit; lower marly interval is Dr. Burt zone
Environment: open shallow marine, variable wave- and current-energy

Kirschberg Evaporite
Crystalline limestone, collapse breccia, gypsum and porcellaneous limestone: pink to gray, medium- to coarse-crystalline, massive- to thin-bedded, cherty, crystalline limestone and travertine containing intervals of limestone-, dolomite-, and chert-fragment collapse breccia, overlain by light-gray, thin-bedded brittle porcellaneous to lithographic micrite, commonly collapsed and brecciated; in northern Gillespie County interval contains massive gray gypsum; upper boundary conformable, ranges from gradational to abrupt

DEPOSITIONAL ENVIRONMENTS

SUPRATIDAL | INTERTIDAL | SHALLOW MARINE RESTRICTED | SHALLOW MARINE OPEN | OPEN SHELF

LITHIC LOG

300′ 280′ 260′ 240′ 220′ 200′ 180′ 160′ 140′ 120′ 100′ 80′ 60′ 40′ 20′ 0′ 20

DOLOMITE CONTENT

DOLOMITIC LIMESTONE | CALCITIC DOLOMITE | DOLOMITE

LEGEND

A. SKELETAL PARTICLES

Foraminifera

miliolids — Orbitolina
Globigerina — Dictyoconus

Corals

Cladophyllia — colonial mass

Algae

dasyclad stalk — calcispheres
stromatoporoid

Molluscs

caprinid — snail
radiolite — oysters
Toucasia — small flat clams
Chondrodonta — heart clams

B. MINERAL CONSTITUENTS

carbonaceous streak — sparry calcite — unidentified allochems
chert nodule — celestite — dolomite
disseminated chert — gypsum-anhydrite
pyrite — quartz sand

C. SEDIMENTARY STRUCTURES

burrows — cross-bedding — bored surface
wispy, nodular — rock fragments
ripple marks — hardcrust or stromatolitic layer

D. DIAGENETIC STRUCTURES

collapse structure, spar-filled — pulverulite
collapse structure, mud-filled (or channel conglomerate?) — travertine
spar-filled anhydrite nodule — spar-filled fracture

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FIG. 24. Generalized columnar section, Segovia Formation, eastern Edwards Plateau, Central Texas.

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NOTE: Base of Edwards mapping in Gillespie County after V. E. Barnes (1952-1967)

TEXAS

LOCATION MAP

EXPLANATION

Buda Limestone
Light yellowish-gray, nodular marl and marly limestone, commonly deeply calichified

DISCONFORMITY

Del Rio Clay
Yellowish-brown, soft, silty, calcareous clay with thin coquinoid limestone beds rich in Exogyra arietina

DISCONFORMITY

Devils River Formation
Light gray, bioclastic, cherty limestone particularly rich in rudistids; altered and recrystallized cherty limestone; brownish-gray dolomite; in the basal part, nodular massive limestone

Edwards Group

COMANCHE SERIES

Segovia Formation--Light gray, cherty, miliolid, shell fragment, and rudistid limestone; medium brownish-gray, porous, massive and thin-bedded, cherty dolomite; collapse breccia; in the basal part, light yellowish-gray miliolid limestone and marl and marly limestone with Exogyra texana, oxytropidocerid ammonites (= Dr. Eurt Bed); three key-bed mapping units: the "Gryphaea Bed" (= G), the "Orr Ranch Bed" (= O), and the "Black Bed" (= B)

Fort Terrett Formation--In the upper one-fourth, porcellaneous limestone, collapse-breccia, cherty, recrystallized limestone and, locally, gypsum (= Kirschberg Evaporite); light to dark gray, cherty, miliolid, shell fragment, and rudistid limestone and medium brownish-gray dolomite in the middle; nodular limestone in the lower fourth, and a thin yellow clay with abundant Exogyra texana at the base

DISCONFORMITY

Trinity Division
(includes older rocks in a few places)
Glen Rose Formation (interbedded yellowish-gray clay and thin-bedded limestone and dolomite)
Hensel Formation (red to brownish-yellow calcareous sandstone and siltstone)
Various Paleozoic and Precambrian formations in local areas

U/D — Fault
U, upthrown side; D, downthrown side

EN — Measured section

x16 — Locality with number

Well location

Base adapted from Army Map Service 1°x 2° map series

Geology by P.R. Rose, 1967

GEOLOGIC MAP OF EASTERN EDWARDS PLATEAU, TEXAS

Scale 1:250,000

5 0 5 10 15 20 Statute Miles

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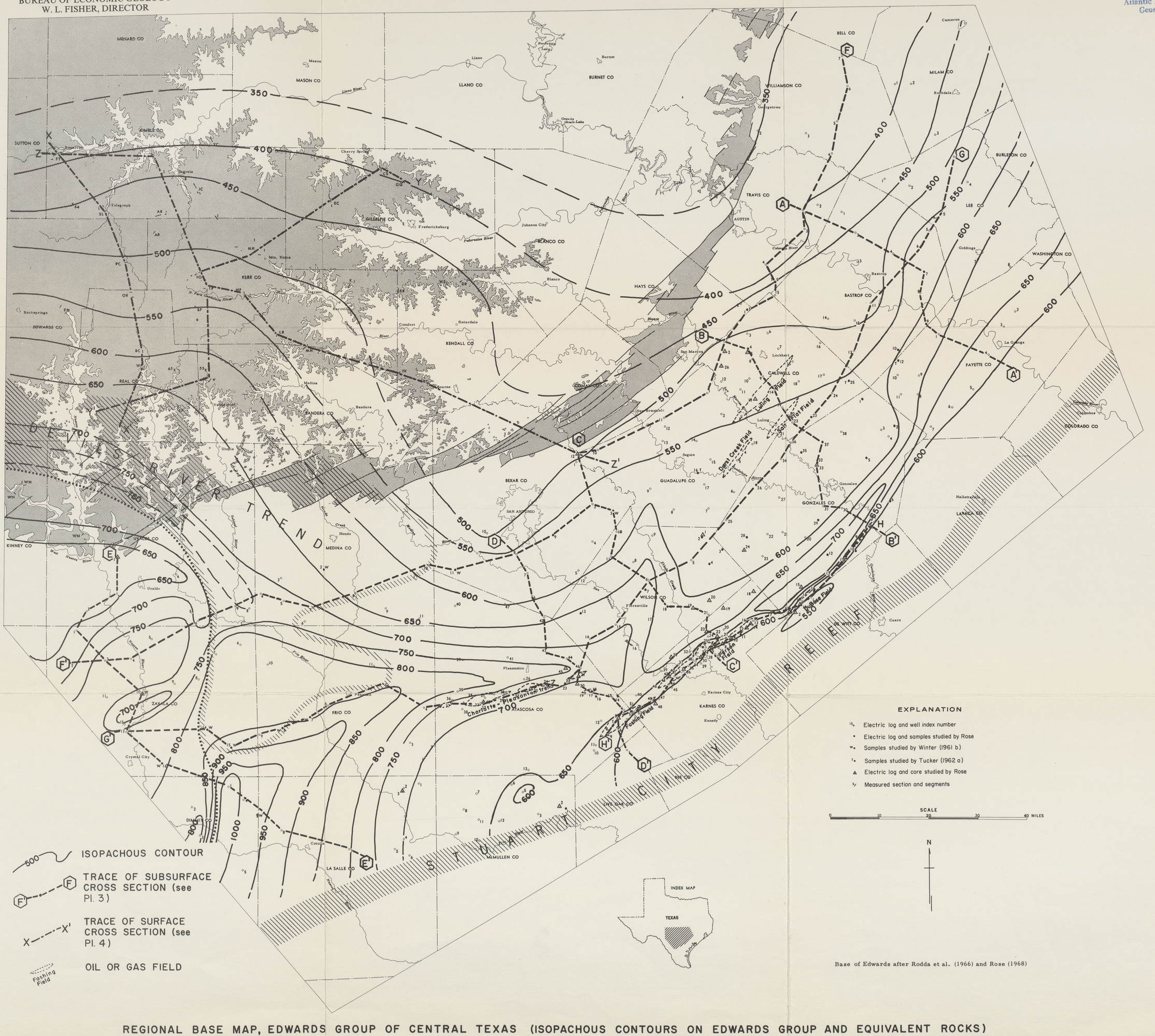

Base of Edwards after Rodda et al. (1966) and Rose (1968)

REGIONAL BASE MAP, EDWARDS GROUP OF CENTRAL TEXAS (ISOPACHOUS CONTOURS ON EDWARDS GROUP AND EQUIVALENT ROCKS)

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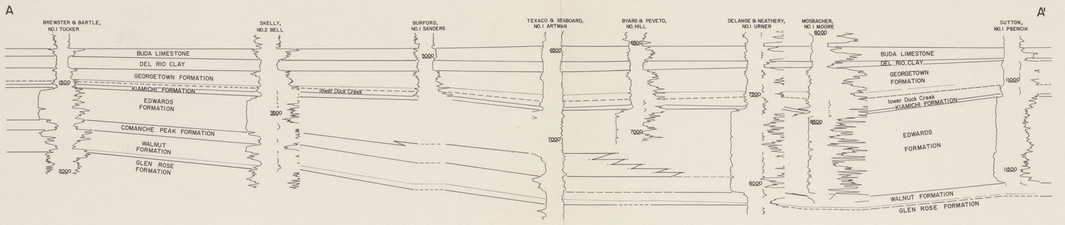
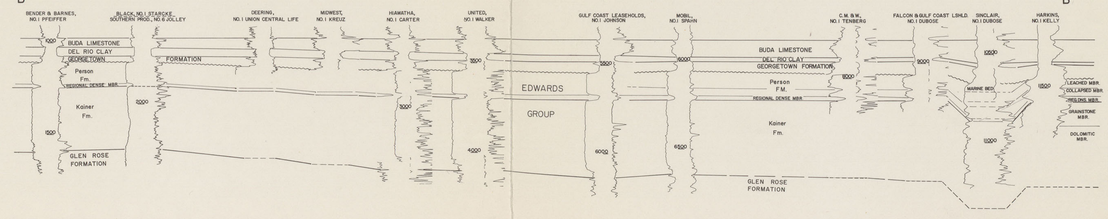
EDWARDS GROUP, CENTRAL TEXAS
PLATE 3

NORTHWEST
A



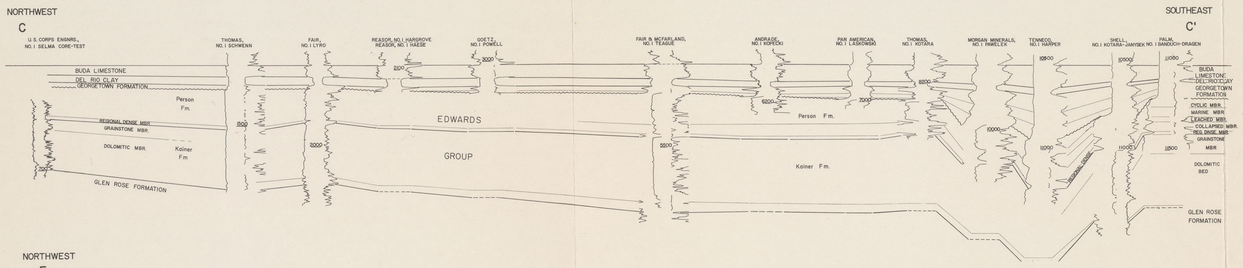
SOUTHEAST
A'

NORTHWEST
B



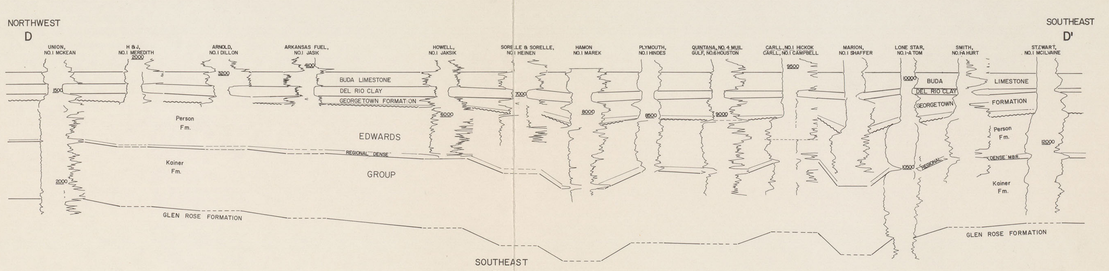
SOUTHEAST
B'

NORTHWEST
C



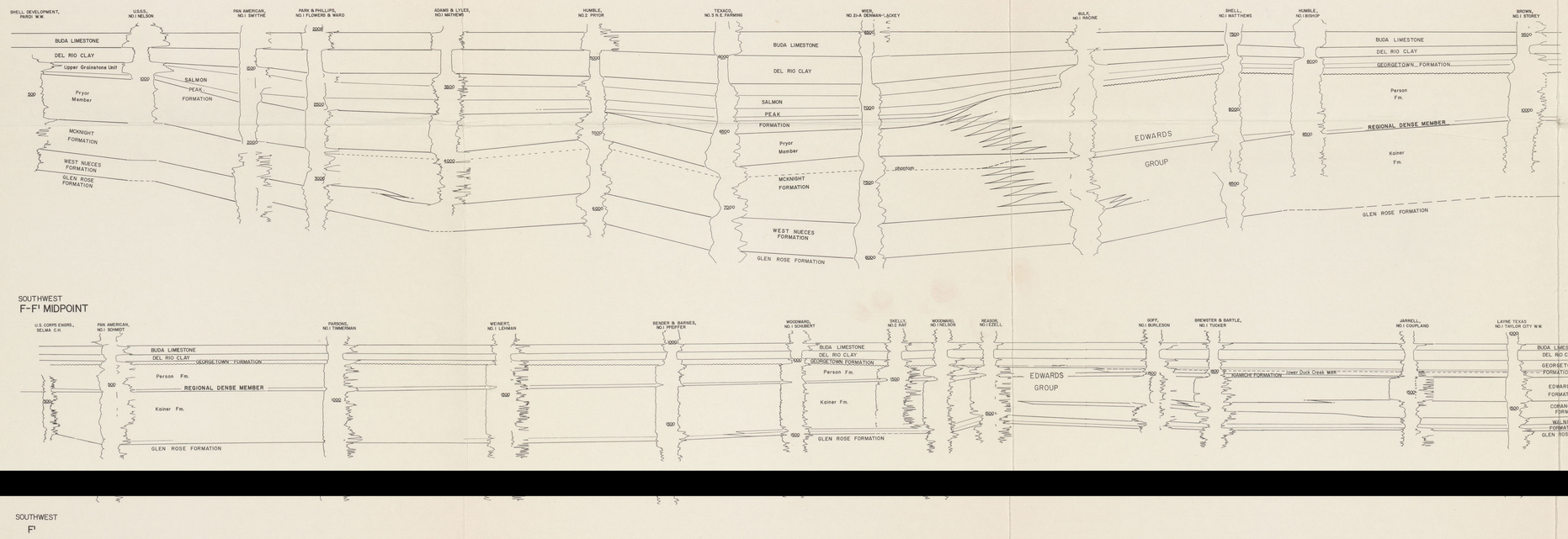
SOUTHEAST
C'

NORTHWEST
D



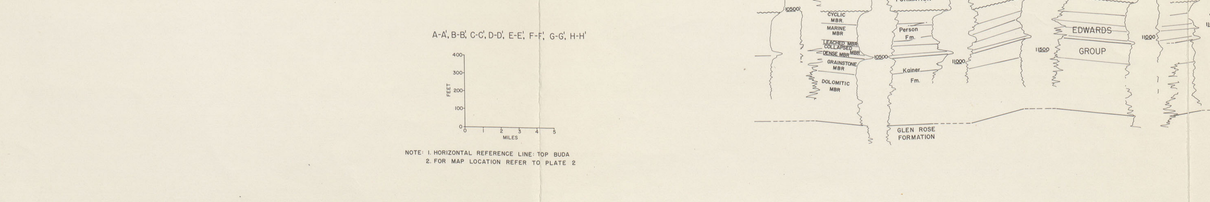
SOUTHEAST
D'

NORTHWEST
E

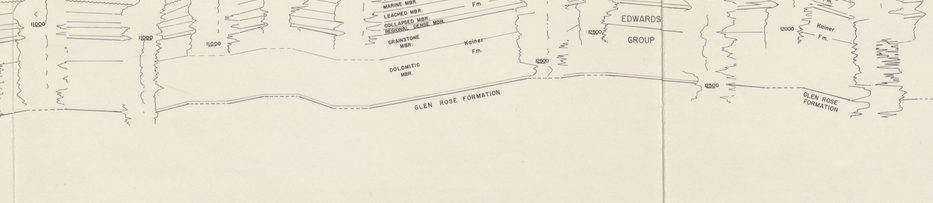


SOUTHEAST
E'

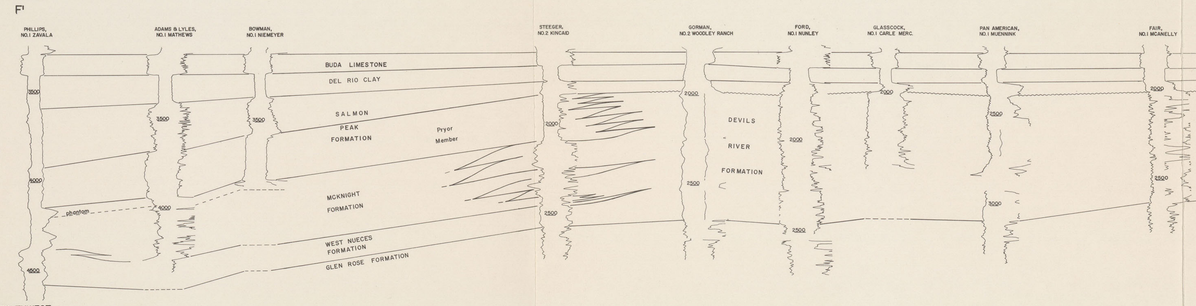
SOUTHWEST
F-F' MIDPOINT



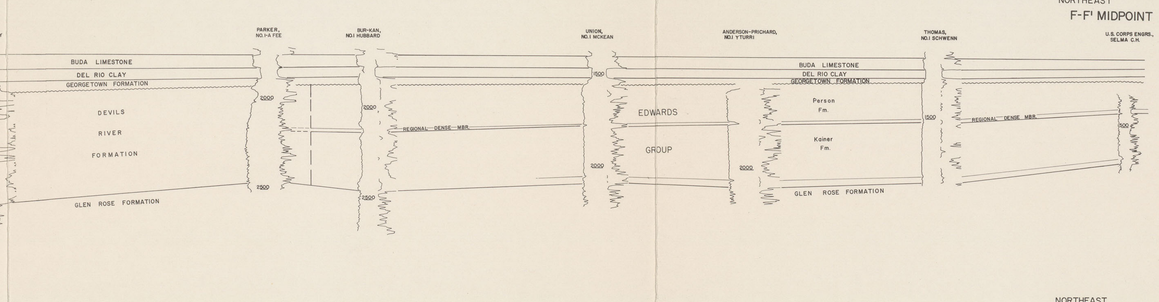
NORTHEAST
F



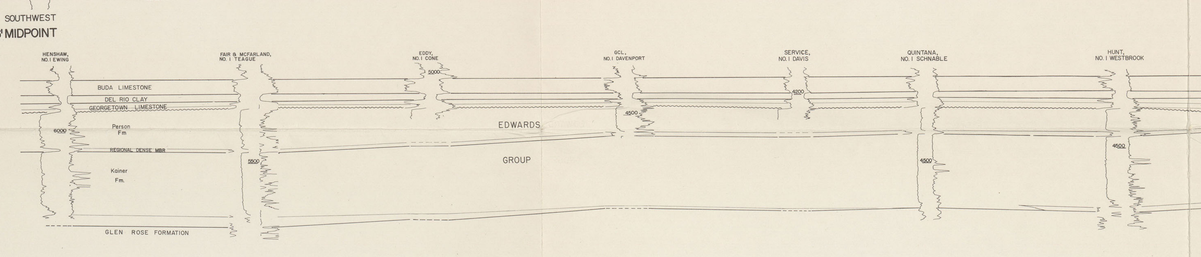
SOUTHWEST
F'



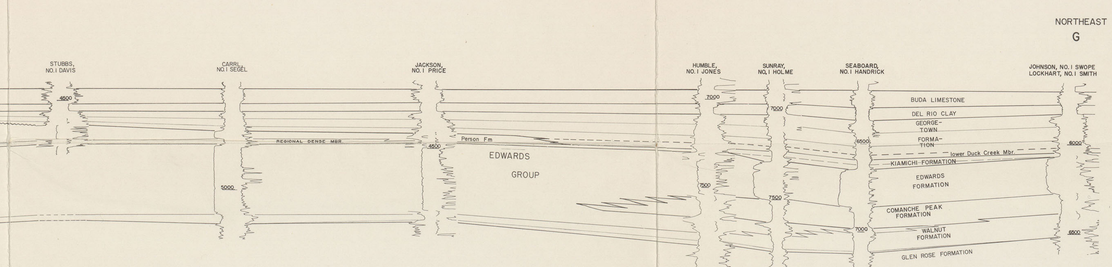
NORTHEAST
F-F' MIDPOINT



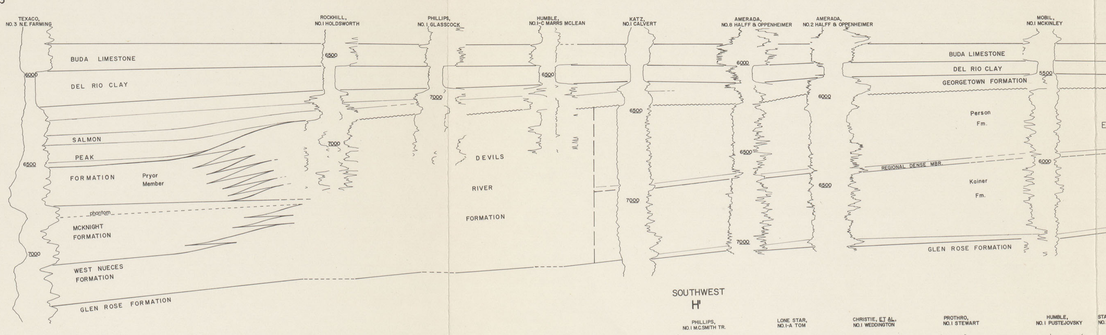
SOUTHWEST
G-G' MIDPOINT



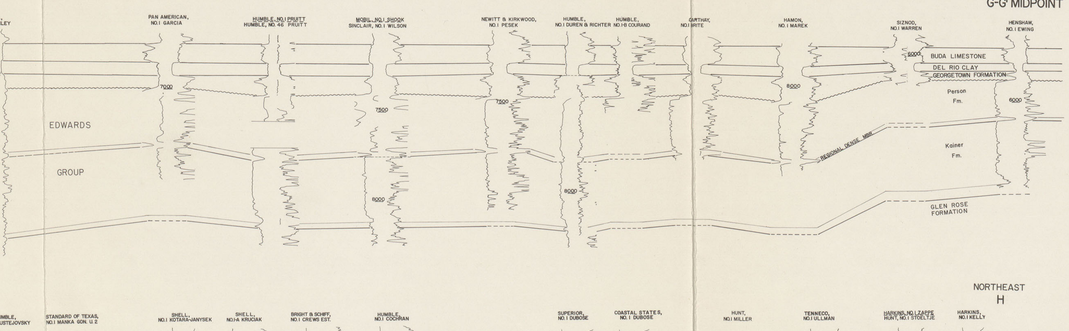
NORTHEAST
G



SOUTHWEST
G'



NORTHEAST
G-G' MIDPOINT

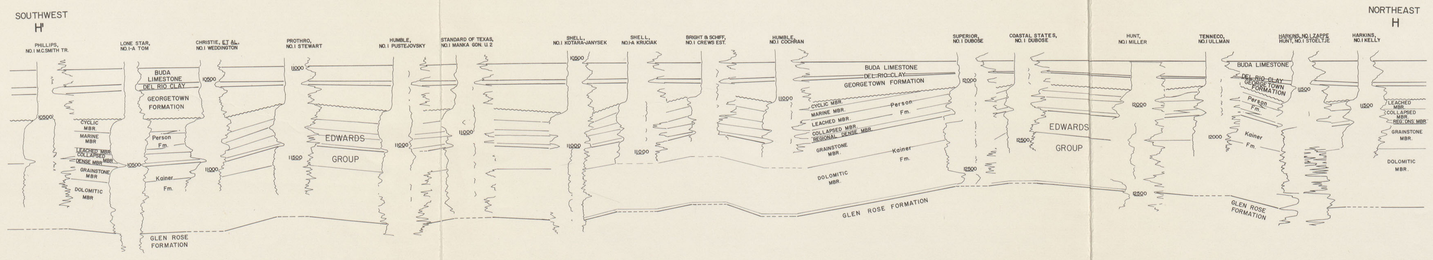


SUBSURFACE CORRELATION SECTIONS

A-A', B-B', C-C', D-D', E-E', F-F', G-G', H-H'

NOTE: 1. HORIZONTAL REFERENCE LINE TOP BUDA
2. FOR MAP LOCATION REFER TO PLATE 2

SOUTHWEST
H'



NORTHEAST
H

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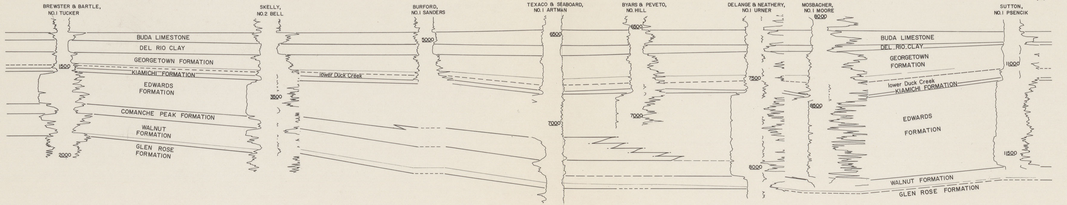
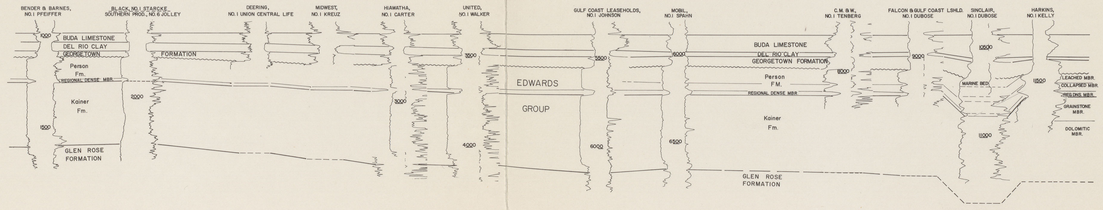
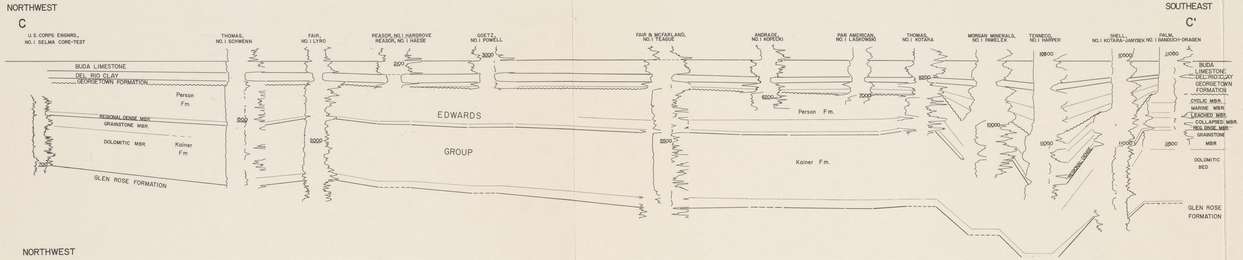
NORTHWEST — SOUTHEAST
A — A'



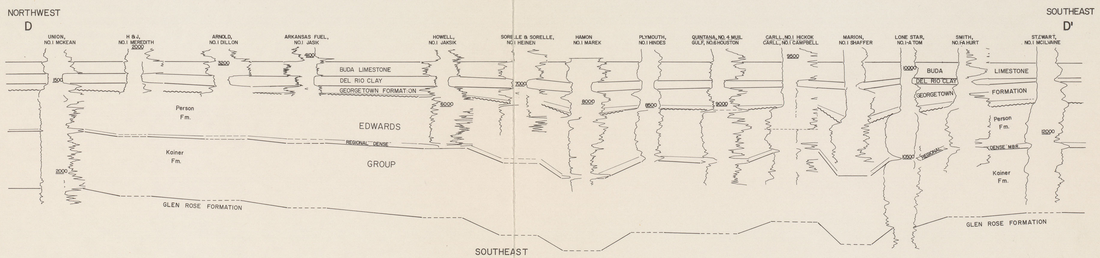
NORTHWEST — SOUTHEAST
B — B'



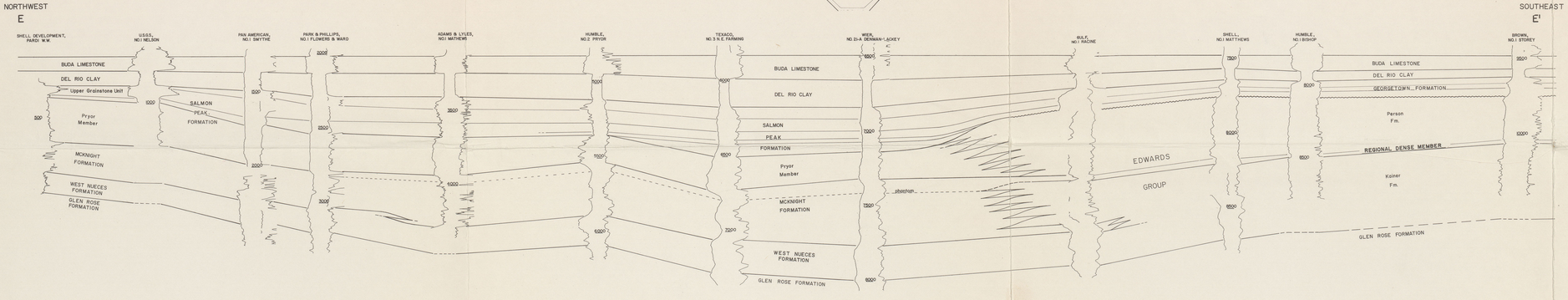
NORTHWEST — SOUTHEAST
C — C'



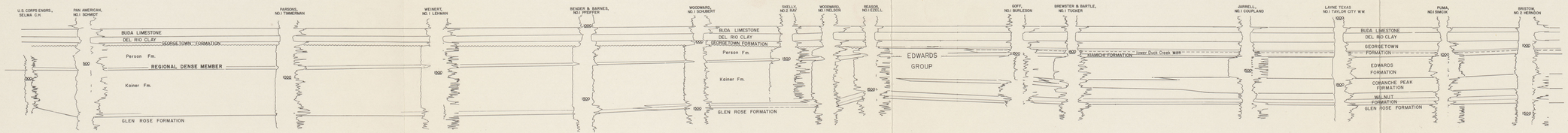
NORTHWEST — SOUTHEAST
D — D'



NORTHWEST — SOUTHEAST
E — E'



SOUTHWEST — NORTHEAST
F-F' MIDPOINT — F

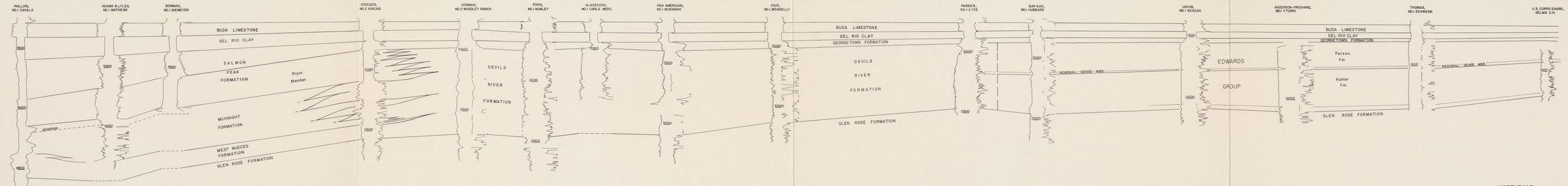


SOUTHWEST

F

NORTHEAST

F-F' MIDPOINT

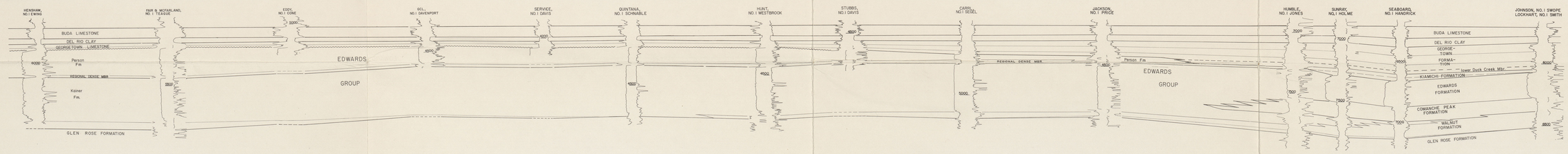


SOUTHWEST

G-G' MIDPOINT

NORTHEAST

G

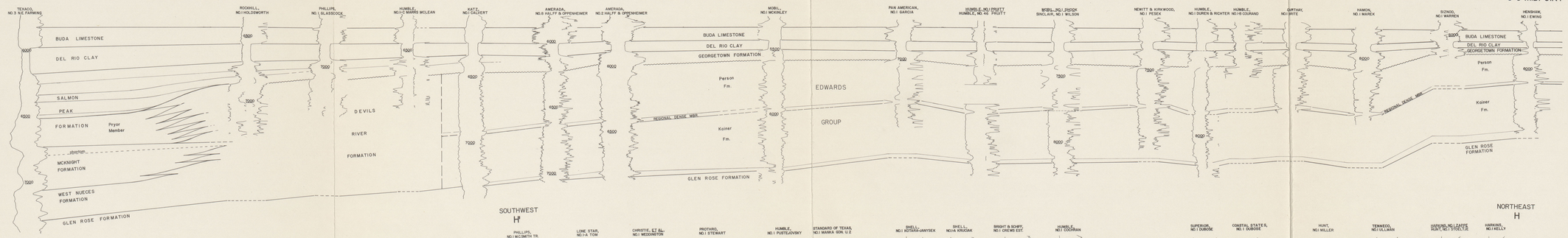


SOUTHWEST

G'

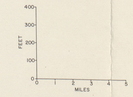
NORTHEAST

G-G' MIDPOINT



SUBSURFACE CORRELATION SECTIONS

A-A', B-B', C-C', D-D', E-E', F-F', G-G', H-H'



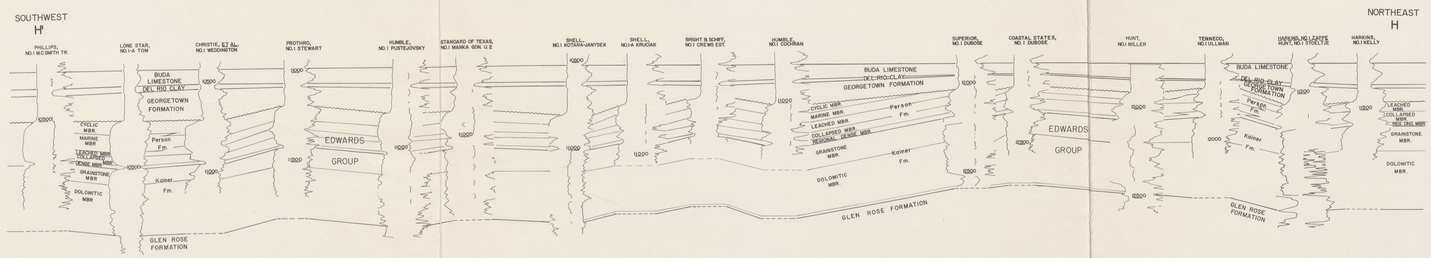
NOTE: 1. HORIZONTAL REFERENCE LINE TOP BUDA
2. FOR MAP LOCATION REFER TO PLATE 2

SOUTHWEST

H'

NORTHEAST

H



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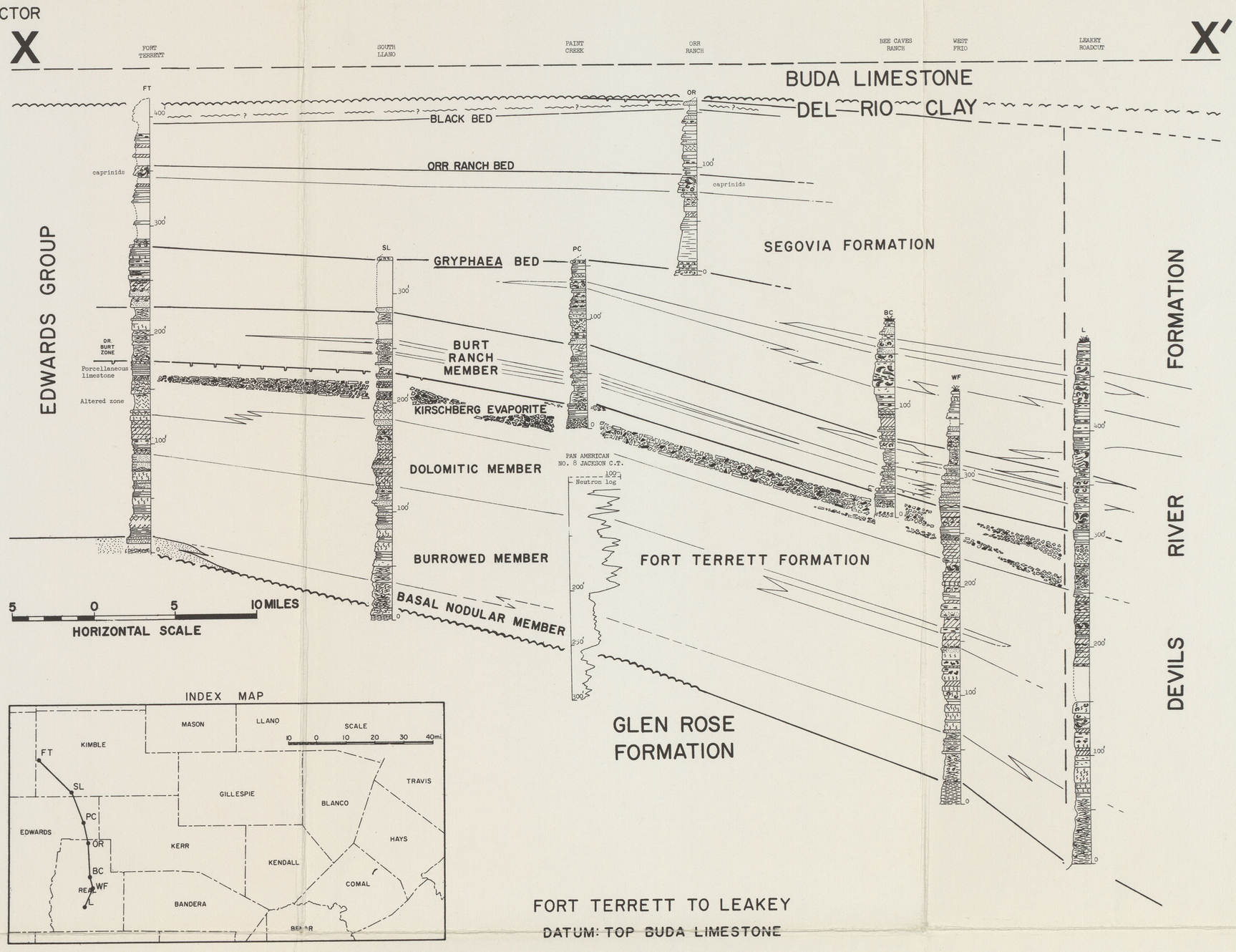

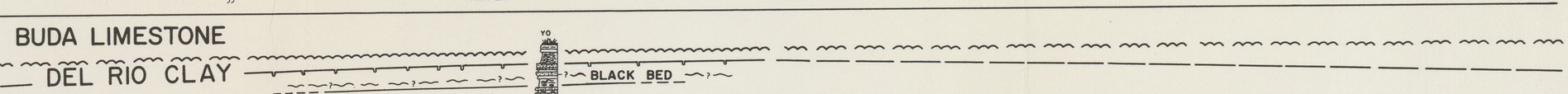

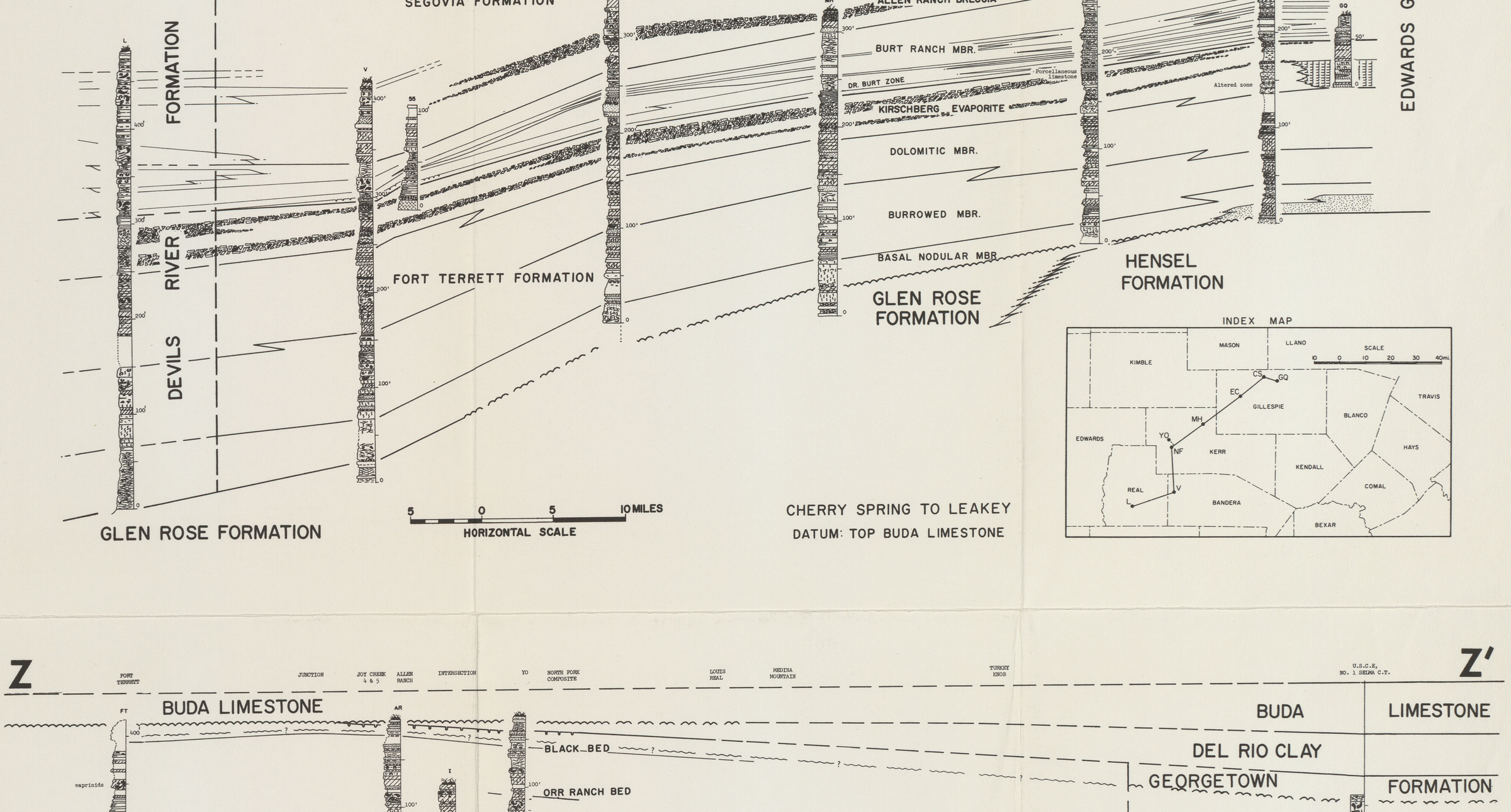

STRATIGRAPHIC CROSS SECTIONS